DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

SEPTEMBER, 1941

Oil-well pumps that bring crude oil with its sediment of earth, gravel, and rock to the surface must be built to withstand severe service. The pump valve seats, for example, continuously withstand pressures up to 3000 pounds per square inch while at the same time being subjected to severe shock or pounding as the column of oil is brought from the bottom of the well to the surface—often 5000 feet or more. The manufacture of pump parts requires high-grade materials, accurate machining, and proper hardening of all working members. The methods employed by a well-known manufacturer in this field, the Axelson Mfg. Co., will be the subject of the leading article in October MACHINERY.

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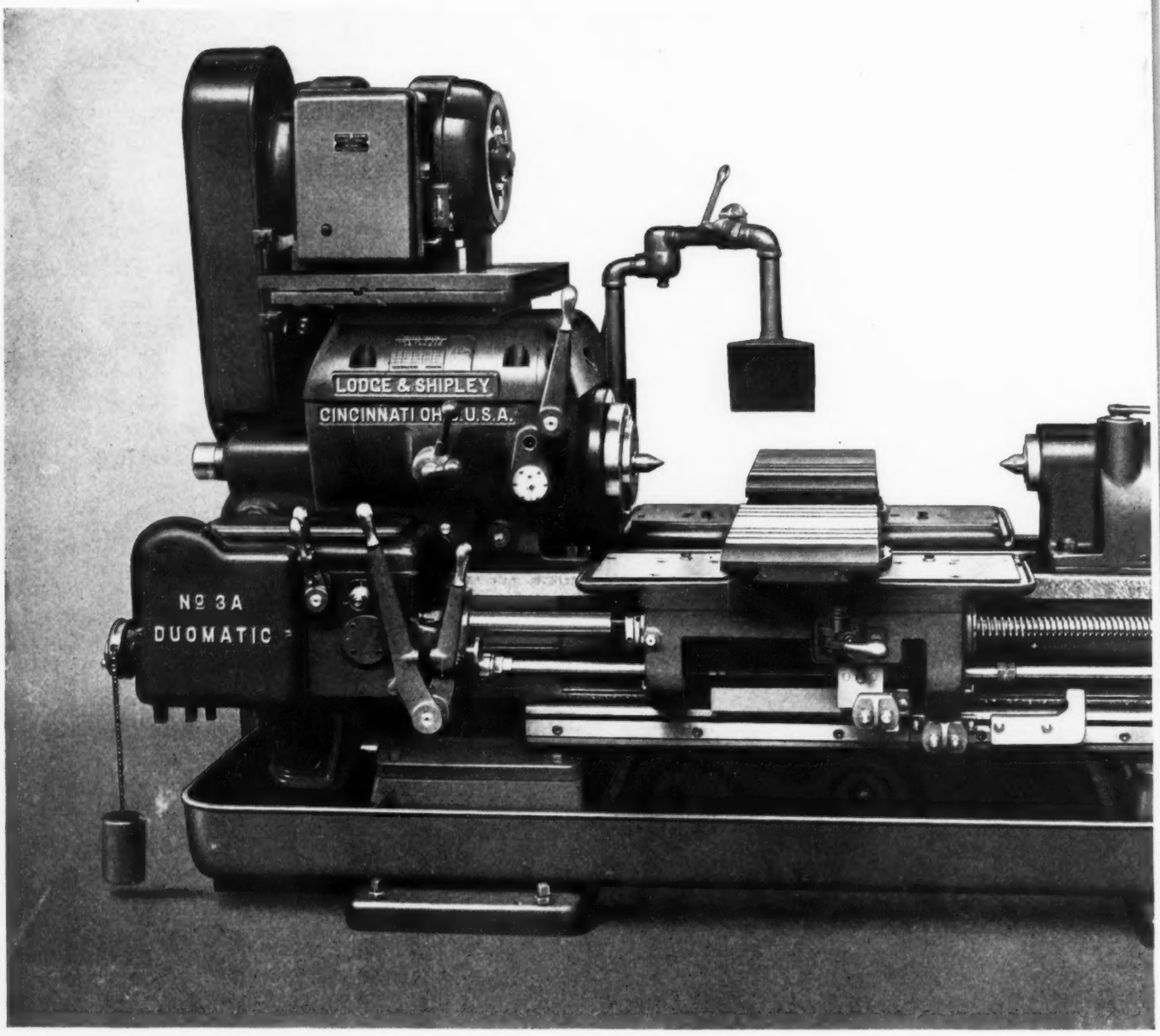

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MACHINERY

Volume 48 NEW YORK, SEPTEMBER, 1941 Number 1

Newly Developed Methods of Making Airplane Templets

Work that Formerly Took Weeks is Now Accomplished in a Few Minutes Time by Means of Photographic and Electrolytic Processes Developed by the Lockheed Aircraft Corporation. These Processes Save up to $20,000 on Each New Airplane Model

By R. A. VON HAKE
Vice-President in Charge of Manufacturing
The Lockheed Aircraft Corporation
Burbank, Calif.

EVERY time that a new airplane model is placed in production it is necessary to provide upward of 25,000 templets of sheet metal to control routing, drilling, punching, inspecting, and other operations. As many as fifty different types of templets may be required for one panel alone, and generally from five to eight templets of each type must be made.

Within the last year or so a number of airplane companies have adopted a photographic method of reproducing templets from accurately made drawings. By this method, templets that may formerly have required several weeks to lay out, are now being reproduced in a matter of minutes.

Fig. 1. The First Step in the Photographic Method of Templet Reproduction Consists of Making a Master Lay-out in Pencil on a Painted Steel Sheet or Other Suitable Metal

The photographic method used in the Lockheed factory is similar to that employed by some other aircraft companies, except for certain major improvements that were developed by the Lockheed photographic and engineering departments. With the photographic method of templet reproduction, the time between the completion of engineering drawings for a new plane and the test flight of that plane has been reduced from two to four months. Although this factor is of utmost importance in the present national emergency, another outstanding advantage is the reduction in templet cost. With the methods used in this plant, there is a saving of approximately $20,000 in the cost of templets for each new plane model.

Fast as the photographic method of templet reproduction is, the Lockheed Aircraft Corporation has recently developed an even speedier process, by means of which templets can be reproduced in less than five minutes. This process consists of electrolytically transferring the lines from a carefully scribed drawing on a steel sheet to other

Fig. 2. Comparing One of the World's Largest Photographic Lenses with a Lens of the Size Furnished in a Speed Graphic Camera

Fig. 3. Setting up a Plate-glass Negative for a Templet in Front of the 34-foot Long Enlarging Camera

sheets of metal for use as templets. The two processes are not competitive. Each has its distinct place and use, and each serves its particular purpose in obtaining the ultimate in both economy and that very necessary requirement, "speed."

The photographic method is used to reproduce all types of lines for the engineering department on tracing cloth at either full or at a reduced scale. These photographically made tracings are used to make blueprints for general distribution throughout the factory. Small-scale engineering lay-outs may also be photographed and enlarged, and then printed full size on plywood or other suitable material for making full-size "mock-ups" of the airplane.

For the photographic process, a group of loftsmen usually develop the lines or surface shape of the entire airplane at either full or reduced scale. Many of these lay-outs are photographed and printed at a greatly reduced scale for use in making "wind tunnel" models, the reduced-scale prints being made on suitable sheet steel, which can be cut and used as contour templets in making and checking the wind tunnel model. Shrink templets for use in making patterns and plaster "mock-ups" can be readily produced by the camera at an increased scale, such as 1/10 or 1/8 inch per foot over full size.

The electrolytic process is used for making full-size reproductions of all types of lay-outs. As all reproductions made by this system are a "contact copy reproduction," this eliminates any possibility of error and insures an absolutely accurate reproduction. Owing to the simplicity and economical features of this process, it is often advantageous to take a photographic print and scribe over the printed lines, so that a large number of reproductions can be made by the electrolytic method, thus obtaining the highest saving possible by combining both systems. The photographic reproductions generally used in these cases are those that have been either enlarged or reduced by the camera, or those that were made by the camera under con-

Fig. 4. Developing a Tracing on which the Data on a Glass Negative has been Photographed to Provide a Means of Obtaining Blueprints

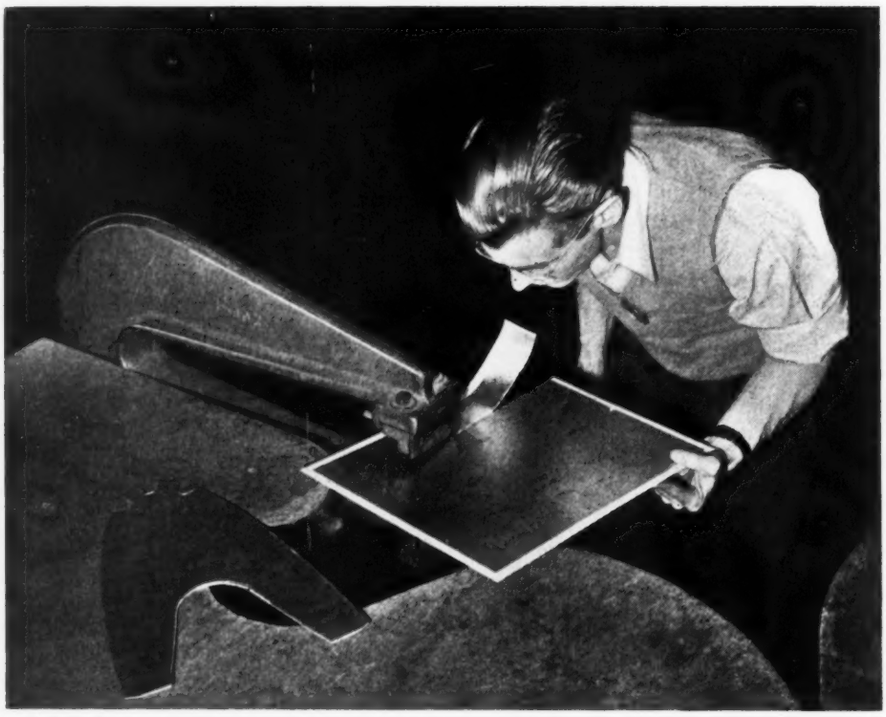


Fig. 5. Cutting Out a Templet According to Lines Photographed on the Sensitized Metal Sheet from the Plate-glass Negative Made from the Master Lay-out Sheet

ditions where it was physically impossible to move the original lay-out. For example, the lay-out may be on part of the loft floor or a drawing that cannot be handled.

Under what specific conditions the electrolytic and the photographic processes of templet production, respectively, will be used in the Lockheed factory, depends upon further experience. With either process, it is unnecessary to duplicate manually an engineering drawing after it has once been made.

The photographic process starts with the laying out by loftsmen of the mold-line contours or the exact shape of the airplane. These line contours are drawn full-scale on sheet steel, about 0.048 inch thick, which has been previously processed with a coating of paint. Pencils or ink can be used on the painted surface just as readily as on tracing cloth or paper. Most lay-outs are made with a pencil of medium hardness.

After the mold-line contours have been put on by the loftsmen, the metal sheets are turned over to a group of detail lay-out men who develop the three views of the part full size on the same steel sheets. The drawings are made in the conventional way, except that no dimensions are given. Upon completion, these lay-outs are checked by design and stress engineers.

The templet drawings are developed right on the three-view lay-outs whenever it is possible to do so without causing confusion. They may be made on the same steel sheet, but placed to one side of the three views, so as to avoid confusion and present clearly the information that is to be transmitted to the manufacturing departments. The templet drawings show clearly in every detail the shape of each part, and include stringer cut-outs, rivet or bolt locations, and all other information needed by the fabrication department in cutting and drilling parts before they are formed to the required shapes. All tooling information is also given on these lay-outs.

These full-size drawings on metal are next photographed on a 14- by 17-inch glass negative, after which the original lay-out is returned to the engineering department and filed as a permanent reference. The negative is used to make five or six full-size prints on metal by means of enlarging equipment. The same negative is also used to reproduce the drawing on sensitized tracing cloth, generally at a smaller scale, for convenience in filing and handling in the shop and the engineering department.

The information provided on the full-size, exact-scale reproduction on metal of the original lay-out is useful to a number of plant departments. One or more copies are provided to the templet department, where all necessary templets are made by merely cutting out various views from the full-size prints. These include flat patterns, forming block or contour templets, and jig and tool templets. The templet inspection department also receives one copy to refer to in checking the workmanship on templets after they have been cut out, while the tool design department uses many of these full-size lay-outs in designing and building assembly and drill jigs. Sometimes it is possible to use this type of lay-out as a portion of an assembly jig by simply providing hardened drill bushings in the proper locations or by mounting blocks on the lay-out for locating and holding parts while they are being assembled by means of rivets, bolts, or spot-welding.

Inspectors of finished parts find the full-size lay-

outs useful in checking formed and fabricated parts. Considerable time is saved by this method of visual inspection, in which the finished parts are checked against lines on the plates, compared with the time previously necessary when each individual dimension had to be measured. With all dimensions eliminated from the lay-outs, it becomes necessary for inspection to be done by this quick method. The practice of not dimensioning the various detail parts on lay-outs also eliminates numerous dimensional changes, previously necessary when wrong dimensions were placed on drawings due to errors in scaling or calculation.

In conjunction with the lay-outs that are furnished to the shop for reference, other full-size lay-outs are made on the loft to detect interferences of fuel lines, electrical lines, etc., and the correct relationship of various parts as installed on the plane. This type of interference lay-out facilitates the checking of numerous assemblies, such as the landing gear, wings, and fuselage. It is not necessary to print this type of lay-out full size on metal, the information generally being furnished to the shop in the form of blueprints. The tracings from which the blueprints are reproduced are usually made either one-fourth or one-half size.

Photographs of the original lay-outs are made with the lay-out sheets lying on the loft floor. The pictures are taken by the camera seen in the heading illustration, which looks more like a miniature oil derrick than a camera. The camera is mounted at the top of the derrick-like housing and points straight down, there being a distance of about 8 1/2 feet between the camera lens and the lay-out. The camera focus is fixed for taking photographs one-quarter full size. The camera is equipped with a standard Cooke f:12.5 process lens having a focal length of 19 inches. Glass photographic plates are used, as film would shrink and make the reproduction of accurate templets a difficult problem.

The camera housing is covered with sheet metal to keep out all outside light. Eight fluorescent tubes, 48 inches long, are provided on the inside of the housing to light up the drawing for taking the picture. The camera housing is mounted on rubber wheels, about 6 inches in diameter, to facilitate movement about the loft. It would be possible to wear off the rubber of the tires as much as 1/8 inch without reducing the accuracy of the focus. However, the focus is checked every two weeks. Under this system, pictures can be taken by a loftman who is not a photographer.

Enlargement of photographs on sensitized steel plates for use as templets is accomplished by means of a combination camera and projector 34 feet long, which is an adaptation of standard equipment used in the photo-engraving industry. This camera is fitted with one of the world's largest camera lenses, as may be seen in Fig. 2, in which the lens is compared with a lens such as is supplied in a Speed Graphic camera.

Fig. 6. Checking the Outline of a Templet Directly on the Lines of a Reference Inspection Sheet that was Photographed from the Same Master Lay-out as the Templet

Fig. 7. Inspector Checking a Blanked and Formed Piece of Work. This is Done by Laying it on the Lines of a Metal Plate Produced by the Photographic Process

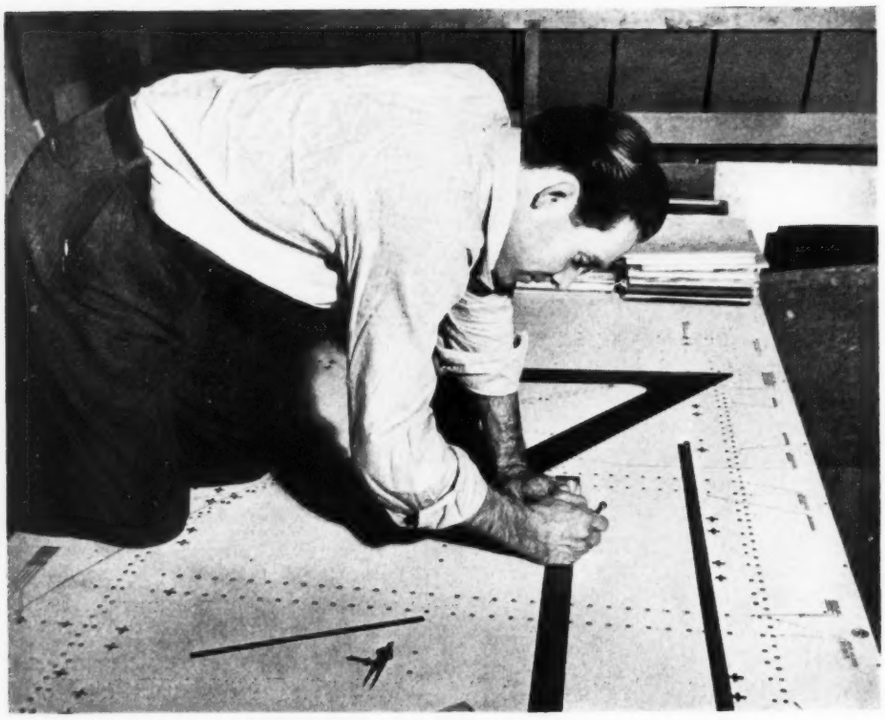


Fig. 8. First Step in Producing a Work Templet by the Electrolytic Transfer Process is to Scribe the Lay-out on a Metal Sheet Insulated by a Coating of Paint. This Work is Done on the Templet Loft Floor

The "dark room" of the camera, instead of consisting of a bellows and ordinary camera box, is actually a 17- by 25-foot room. The lens is set into the wall of this room. The sensitized metal plate on which the negative drawing is to be enlarged is suspended vertically in this dark room, while the negative is set up in another 17- by 25-foot room on the other side of the wall partition that houses the camera lens. The distance between the negative and the sensitized plate can be adjusted according to the size of the required projection, but the lens is stationary at all times. In Fig. 3 a photographer is shown setting up a negative preparatory to making an enlargement.

The giant camera is used to project the reduced-scale negative back to full size on the sensitized plates within an accuracy tolerance of 0.001 inch per foot. Metal sheets up to 4 by 12 feet can be handled by the equipment. They are carried from the camera to the various processing tanks by means of overhead electric cranes. The developing tank is 12 1/2 feet long by 5 feet deep, by 3 inches

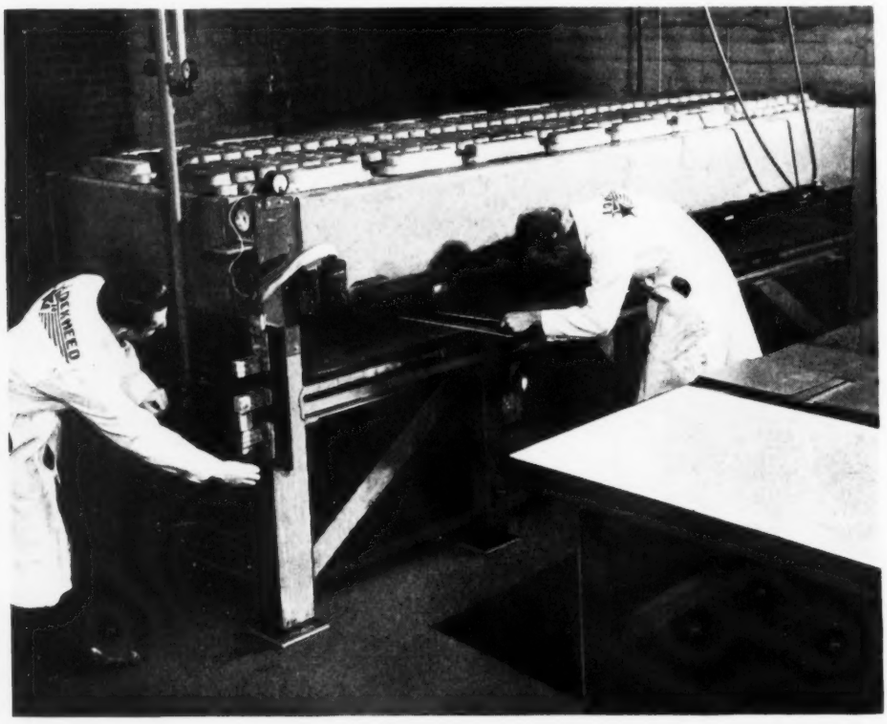


Fig. 9. An Air-operated Press in which the Electrolytic Transfer Process is Carried Out with the Master Lay-out Sheet and Metal Copy Plate Firmly Held between Thick Pads of Rubber Fastened to the Press Table and Ram

Fig. 10. Removing the Master Lay-out and Copy Plates from the Press at the End of an Operation, the Master Lay-out Sheet being Customarily Placed on the Platen and the Metal Copy Plate on Top of the Master

wide. It holds 115 gallons of developer. The hypo tank is of the same length and depth, but is 2 feet wide, and holds 900 gallons of solution. In a single loading of the tank, 1800 pounds of hypo, or nearly one ton, is shoveled in. All the processing tanks are water-jacketed and held at a constant temperature by a refrigerating system.

In using the plate negatives for the reproduction of blueprints at a smaller scale than full size, the position of the negative with respect to the camera lens is changed from that in which it was located in making the full-sized metal reproduction. Also, sensitized tracing cloth is used instead of the sensitized steel plate. After the tracing cloth has proceeded through a process identical to that followed in making photographs, it can be used for making blueprints in the usual way.

No matter how complicated a templet is, the time required for making metal duplicates is no greater than that necessary for the simplest lay-out, whereas there was a vast difference in labor involved when the templets were laid out manually.

The sensitized metal sheets with drawings photographed on them are carefully sheared and filed to the required templet outlines, a typical shearing operation being illustrated in Fig. 5. Here the operator is carefully cutting the excess material from a metal photograph; at the left is seen a templet that was previously cut out to the desired outline.

In Fig. 6 the inspector is laying a sheared templet directly on a steel reproduction of the original lay-out, so that he can check the accuracy with which the various contours follow the desired outline. In Fig. 7 another inspector is seen checking a piece of work which has been routed from an aluminum-alloy sheet under the control of one of the templets seen in Fig. 6 and then formed under a hydraulic press; the work is laid on the same steel drawing as was used in checking the templet.

Making templets by the electrolytic process is exceedingly simple. The original drawing is made either on paper or on prepared sheet steel; on steel, a scriber is used instead of a pencil. When the latter method is followed, it is not necessary to duplicate the information, as the reproductions can be made directly from the original. Another method consists of transferring all the lines and other detailed information of the scribed lay-out to a metal sheet from which the work templet is cut. The scribing operation is routine, and can be taught to an unskilled employe in a comparatively short time. Such an operation is seen being performed on the templet loft floor in Fig. 8.

The sheet on which the master lay-out is scribed is galvanized iron, 0.040 inch thick. The side of the sheet to be scribed is previously coated with a special insulating primer paint and then with a clear lacquer. This coating provides insulation against electrolytic action, except where it has been cut through by the scribing tool.

In reproducing templets from the master lay-out sheet, both the latter and the sheet of metal to which the drawing is to be transferred are sprayed with a transfer solution. The copy plate is usually unpainted terne-plate, 0.036 inch thick. The wet surfaces of the two plates are then pressed into a firm and uniform contact in the press illustrated in Fig. 9, after which electric current is passed between the plates for a period of about three to five seconds. During this time, the electrolytic action builds up lines of iron on the copy plate corresponding to the scribed lines on the master plate—in other words, opposite all points where

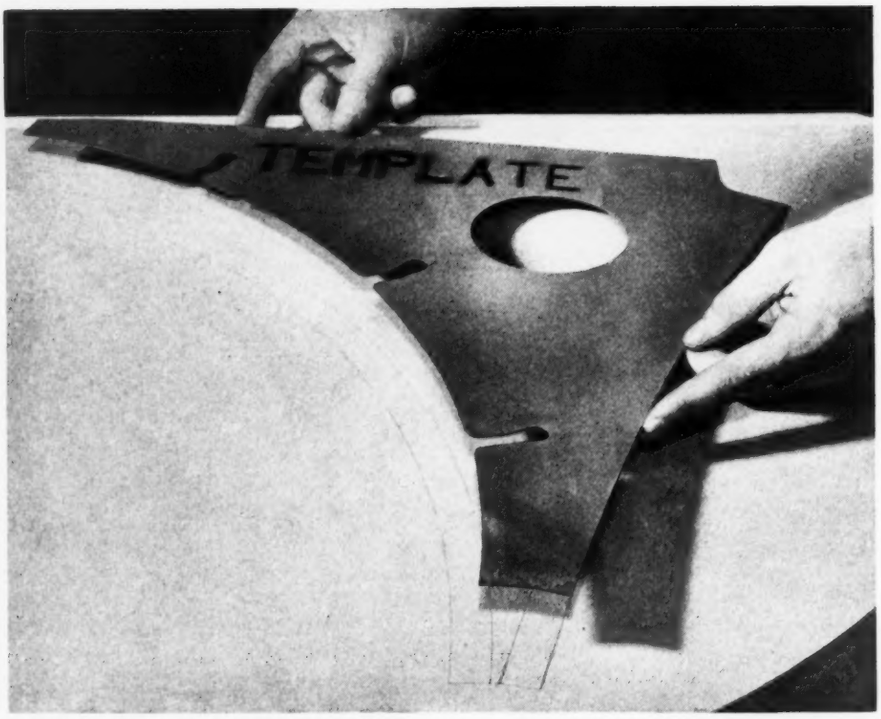


Fig. 11. Checking the Outline of a Templet Produced by the Electrolytic Process by Laying it on the Scribed Lines of the Master Lay-out Sheet

the insulated surface of the master plate was cut through by the scribing tool.

The press is provided with a stationary platen or table and a movable ram, each of which is constructed of heavy steel plates. They are provided with thick pads of resilient sponge rubber on their adjacent surfaces. The ram carries a heavy load of lead ingots to provide the necessary pressure, and is raised and lowered by means of air cylinders at each end of the machine. The rubber pads of both the ram and table carry flexible electrical contact strips, by means of which an electrical potential is applied between the master lay-out plate and the copy plate. Direct current is supplied to these contact strips from storage batteries. The amount of current used depends upon the size of the plates, but the cost is very small. The press illustrated accommodates plates up to 12 feet long by 4 feet wide.

At the end of an operation, the press ram is raised and the two plates are removed, separated, washed, and dried. The copy plate is then given a thin protective coating of clear lacquer, after which it is ready for the templet cutters. No subsequent film hardening or drying is necessary.

The total time required for the electrolytic transfer process, from the time that the copy and master plates are placed in the press until the copy plate is washed, dried, and ready for the templet department, is not more than five minutes. It is estimated that the machine shown, operated by two men, has a capacity for turning out daily as many templets as could be obtained in 500 man-hours of manual copying.

It is expected that a standard hydraulic press will soon be used for this process instead of the machine illustrated. The time required for scribing the master lay-out for the electrolytic transfer process is approximately 5 per cent greater than for making the same lay-out in pencil on paper.

This electrolytic transfer process was developed by C. O. Prest, and is being made available to the aircraft industry in general by the Lockheed Aircraft Corporation.

* * *

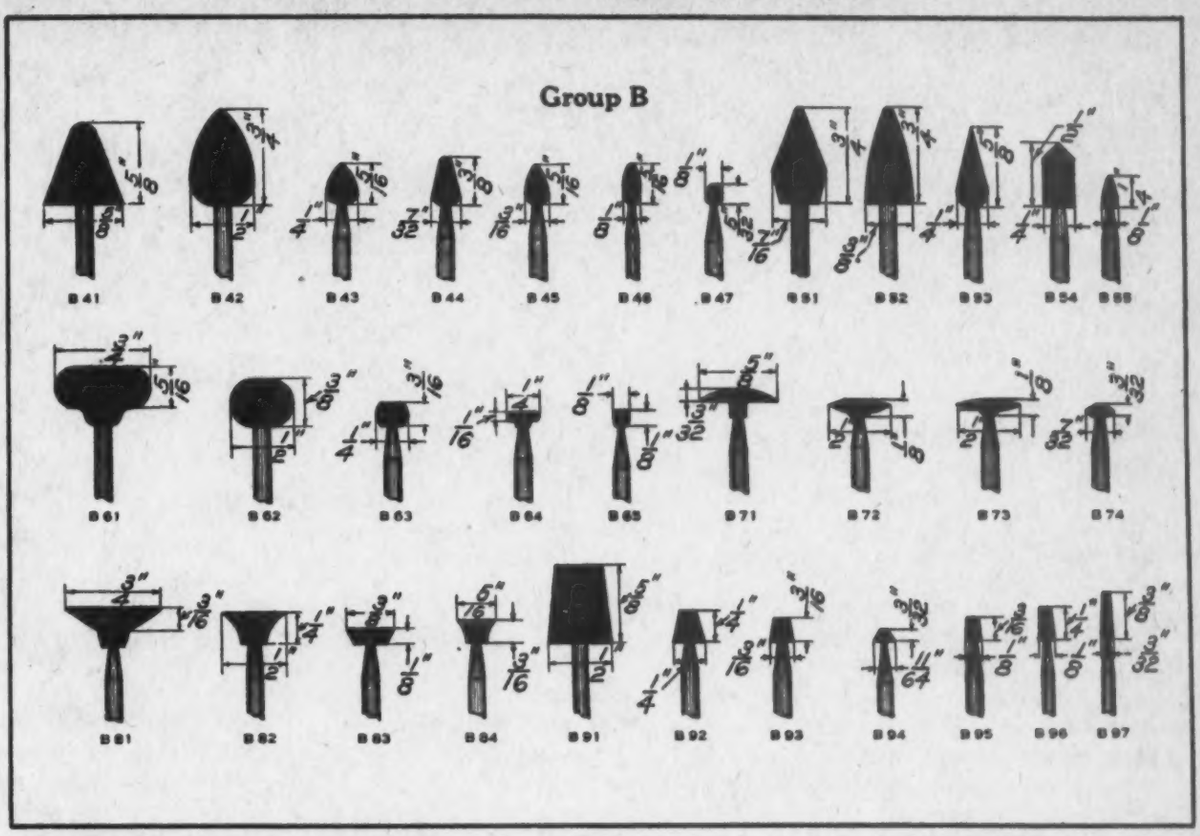
Alice-in-Wonderland Methods of Taxation

In developing our tax legislation, we should recognize that there is no difference between saying by legislative action that one cannot do a thing on the one hand or, on the other, taking all the results or gains from the doing of it. Our tax laws have not as yet sought to accomplish such a complete result, but there is little difference between sudden death and slow death, except in the matter of time and, perhaps, some suffering in the interim.

Trying to put capital to work by imposing heavy taxes, so that government can spend the money, creates a vicious circle by driving more capital out of commerce, requiring still heavier taxes to continue government spending, and so on. We cannot, therefore, impose taxes regardless of their effect on those of our people who, in the normal course, by reason of ability and capital accumulations, are able to accomplish more, and should, therefore, be entitled to more. The existing tax structure and additional levies now under consideration may, if the burden becomes too heavy, stifle the very things that throughout the depression we have been seeking to stimulate, namely, ordinary industrial activity and employment.—*Walter A. Cooper in "A Sound Basis for Taxation"*

MACHINERY'S DATA SHEETS 449 and 450

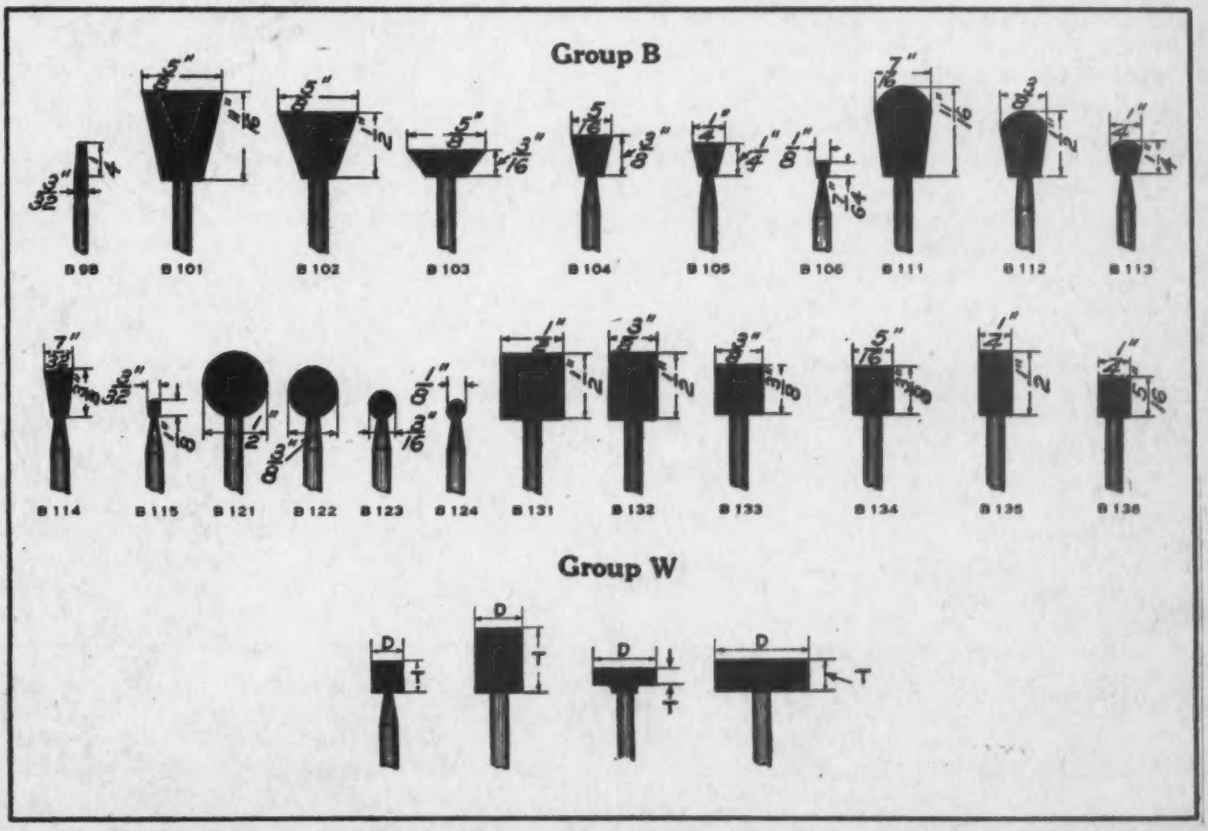
MOUNTED GRINDING WHEELS AND POINTS—3



MACHINERY'S Data Sheet No. 449, September, 1941

Standard of the Grinding Wheel Manufacturers Association

MOUNTED GRINDING WHEELS AND POINTS—4



MACHINERY'S Data Sheet No. 450, September, 1941

Standard of the Grinding Wheel Manufacturers Association

Munitions Cleaning—1941 Style

Review of the Methods and Solvents Applicable to the Cleaning of Shells, Cartridges, Guns, Rifles and Other Materiel—Second of a Series of Articles

By Dr. R. W. MITCHELL
Technical Director
Magnus Chemical Co.
Garwood, N. J.

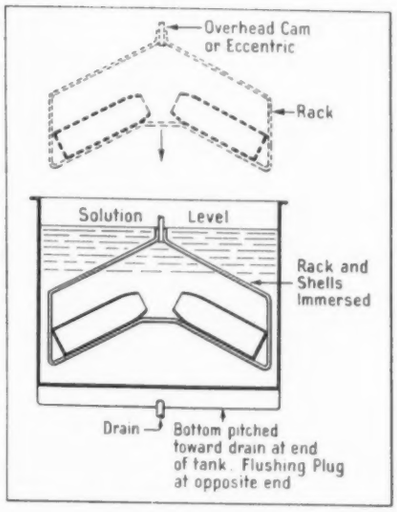

Overhead Cam or Eccentric
Rack
Solution Level
Rack and Shells Immersed
Drain
Bottom pitched toward drain at end of tank. Flushing Plug at opposite end

Fig. 1. Cleaning Arrangement that Holds Shells at an Angle, Agitates Solution, and Tips Rack for Draining Shells

IN the first article of this series, published in August MACHINERY, page 111, the effect of modern manufacturing methods on the cleaning of shells was dealt with, and the efficacy of vapor degreasing and alkaline cleaners in the final cleaning operation was considered. The present article will discuss some factors governing the selection of a cleaner and the advantages of various cleaning methods.

In shell cleaning under the production methods used today, the cleaning problem might be much simpler if it were not for the copper rotating band. Careful selection of a cleaner, however, will obviate any dangers of tarnishing or staining. The essential characteristics of a modern alkaline cleaner are its wetting, penetrating, and dispersing properties. These are the properties that govern its ability to clean speedily and thoroughly. Equally important, however, is the readiness with which the cleaner can be rinsed off. Staining and tarnishing of the work, as well as rapid contamination of the rinse tanks, are direct results of poor rinsing cleaners. Speedy cleaning without staining of the copper band also depends on close attention to the pH of the solution and its wetting and penetrating powers.

The choice of a cleaner depends on the type of cleaning equipment used. When the operation is carried on in still tanks, foaming types of cleaners are easily used, but such cleaners would be impossible to employ in spray type mechanical washing machines. The writer speaks from bitter experience when he stresses the importance of choosing a cleaner with speedy wetting qualities, which also insures rapid, thorough rinsing. The cleaner must have a pH sufficiently high to maintain good dispersion and emulsification, but not so high as to cause tarnishing of the copper band when the cleaning operation involves a dip of more than three minutes in the cleaning tank or contact of the same duration in the washing machine.

As a result of much experimenting and testing during the period which began with the first stages of the Defense Program, a cleaner that has these desirable characteristics was selected for the final cleaning of shells. This cleaner is available in a type suited to tank cleaning where foaming does not present a processing problem, and in a closely

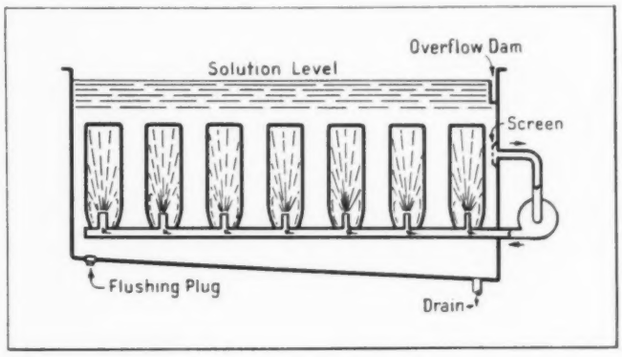


Fig. 2. Shell Cleaning Tank with Solution Circulated in Shell Interiors by a Pump. For Shell Cases, Such Special Devices are not Necessary to Insure Complete Contact of Cleaning Fluid, since Openings at Both Ends Insure Free Circulation

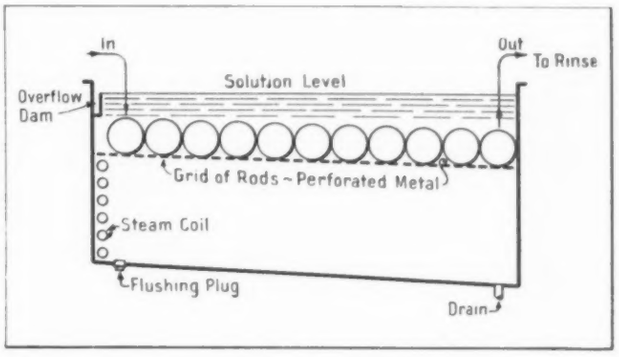


Fig. 3. A Simple Arrangement for Shell Cleaning. Dirty Shells are Placed in the Tank at the Upper End of the Rack, and are Removed One at a Time at the Lower End. A Bent Rod Makes a Good Tool for Agitation and Removal

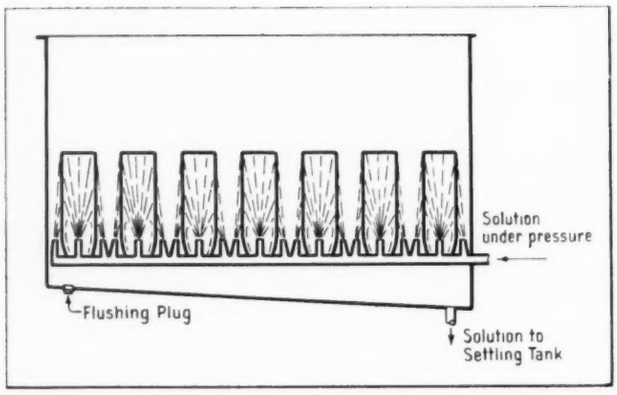


Fig. 4. Arrangement for Rinsing Shells after Use of Emulsifiable Solvent Cleaner

related type which can be used in mechanical washing equipment where the tendency to foam is lacking. The recommendations relating to cleaning methods which follow are all suitable for use with this mildly alkaline cleaner, which the author has found to have superior wetting, penetrating, and dispersing qualities and highly desirable rinsing properties.

Methods of Cleaning Shells

In tank cleaning, the shells are sometimes held on pegs in racks set at about a 30-degree angle from the horizontal, the hole in the nose end slipping over the pin. The pin racks are then lifted or hoisted into the tank. Metal cleaners are available for this operation that will do the job thoroughly in a three-minute dip. The rack is then lifted out again and swiveled to a rinse tank located beside the cleaning tank. This is usually a fairly hot rinse, the purpose of which is to heat up the shell and insure rapid drying preparatory to applying the finish lacquer coat, which ordinarily follows the cleaning operation closely. An arrangement of this kind is shown in Fig. 1.

Still tanks with conveyors carrying the shells through the solution have been tried, but satisfactory cleaning of the interior was difficult, particularly where the cavity was machined instead of forge-finished. This condition can be remedied by agitating the solution or by setting the shells hole down over nipples through which the cleaning solution is circulated, as shown in Fig. 2.

Another cleaning method is shown in Fig. 3. This involves the use of a shallow tank with a slight slope from one end to the other, wide enough to allow the shells to be manipulated for insertion in a horizontal position in the tank. Individual shells are picked up with a bent rod and placed in the solution. After the soak, the operator removes the shells, but before doing so, he lifts the shell with the bent rod to an angle of about 45 degrees and swishes it up and down a number of times, so that the cleaning solution will flow in and out of the interior and flush out loosened dirt particles. Dirty shells are introduced at one end of the tank and clean shells are removed at the other. After removal from the tank, the shell is placed, open end down, on perforated plates for draining (the solution usually being allowed to drain back into the tank) and after a few minutes, is rinsed in hot water at a few degrees below boiling to insure quick drying. This last method may require considerable adaptation to meet large-scale production speed, and, of course, many shells are cleaned in specially designed washing machines which are highly efficient.

The usual requirements are a hot cleaning solution, just short of boiling, which gives off no objectionable fumes or odors, cleans within three minutes at the most, and does not tarnish the copper band, nor involve long rinsing. From the cost viewpoint, alkaline cleaners for this operation vary widely. Short-lived solutions that require too frequent make-up can run the cost of this operation up to rather high levels.

Advantages of Emulsifiable Solvent Method

An emulsifiable solvent method of cleaning, recently developed by the Magnus Chemical Co., offers advantages in the final cleaning of artillery shells. A special solvent is supplied in concentrate form, and this is made up into a cleaning mix by adding about one part of concentrate to eight or ten parts of safety solvent or kerosene. This solution is used in a still tank, into which the shells are dipped in a horizontal position. The emulsifiable solvent cleaner has the property of exceedingly rapid penetration of all deposits right down to the metal surface, loosening them from the metal (even in the case of embedded particles), so that they can be flushed off with a pressure spray of cold water. The solvent and its diluent, safety solvent or kerosene, form an easily rinsed emulsion which is flushed off, together with all the foreign matter. Cold water does a completely satisfactory job, but in order to insure speedy drying of the shell after the rinse, a final hot water rinse is usually employed.

In practice, the operation is very simple, racked shells being dipped for one or two minutes in the solvent solution, lifted to a slightly sloped drain plate above the tank, and allowed to drain for half a minute. They are then moved to water nozzles, which are set to spray the interior of each shell and, at the same time, direct a fanning spray over the exterior, as shown in Fig. 4. When the shells are in position, hot water under pressure is applied through the nozzles, and in a minute, the shells are completely clean, inside and out. The shells are then placed nose down on a final drain rack, where they are ready for painting in half a minute, due to the stored heat of the shell body and the speedy drainage of the water from the cleaned shell.

In the author's opinion, the emulsifiable solvent method of cleaning is preferable to the use of a

vapor degreaser because of the low cost of the cleaning solution. It has an unusually long service life, being capable of steady use for weeks without replacement. The cost of hot rinse water (also capable of being used again and again) is far less than the combined cost of heat and condensing water for the vapor degreaser. After the rinse following the use of emulsifiable solvent, a very thin film of the diluting solvent remains on the shell, acting as a rust preventive in cases where the shell is not immediately painted. The diluting solvent that remains on the shell has no harmful effect on the adherence of the lacquer.

Compared with alkaline cleaners, the emulsifiable solvent cleaner appears to be more suitable in that the concentrate itself and the made-up solution have no effect on the steel or copper of the shell, thus eliminating any possibility of staining or tarnishing. In addition to this, the solution is completely harmless to skin and hands, in contrast to the alkaline cleaner solution. Speed of cleaning is considerably greater, and comparative costs are in favor of the emulsifiable solvent method, due to the use of a concentrate with low-cost solvents and the very long life of the solution. It should be noted, moreover, that the solution itself is nonflammable, and is used at room temperature.

* * *

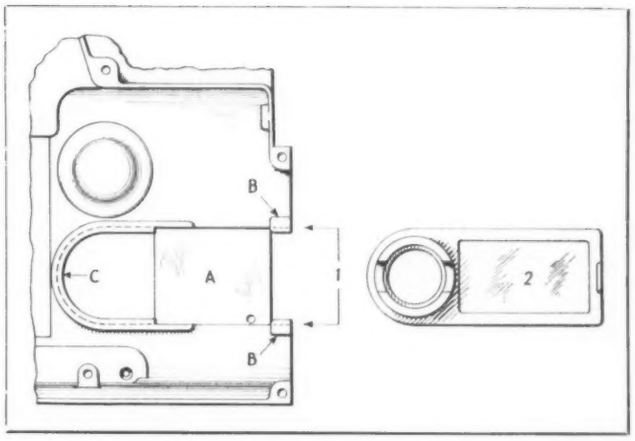
Prevention of Industrial Dermatitis Caused by Chemicals and Oils

Any disease of the skin due to industrial work is called "industrial dermatosis." That type of this disease which is caused by an inflammation of the skin is called "dermatitis"; the latter comprises the majority of all industrial skin troubles.

Because the claims for compensation due to skin damage in industrial work reported to the Office of Dermatoses Investigations of the United States Public Health Service have constituted about 65 per cent of all reported occupational disease claims, and because the economic loss to both employers and employes that arises from skin troubles is largely preventable, the Committee on Healthful Working Conditions of the National Association of Manufacturers has prepared a summary of accepted medical knowledge on the subject. This summary may be used by manufacturers as a source of reference when dealing with the dermatitis problem in their plants.

The importance of the subject may be gathered from the fact that dermatitis was the cause of 49 per cent of all occupational disease awards in New York State in 1937, with an average compensation cost of $159 per case. The average disability per case was thirteen weeks.

The report referred to was prepared to aid in reducing the number and removing the causes of dermatitis infections. The report is available upon application to the National Association of Manufacturers, 14 W. 49th St., New York City.



The Production of This Die-casting was Speeded by a Design that Required No Movable Core

Die-Casting Design Facilitates Production

An interesting example of the part played by careful designing to eliminate a cause that would have slowed up production appreciably, is cited by *The Alloy Pot*. The case in point is the zinc-alloy die-cast frame shown in the accompanying illustration. This casting had a slot (1) to accommodate a separate die-cast slide (2). The slot could have been formed in the casting operation by the use of a movable side core. Movable cores tend to slow up production, however, and this one would have to be exceptionally thin for its length, the thickness of the slide being 1/16 inch. The use of a movable core was avoided by the following design features:

The web *A* is easily formed between the two halves of the die. The front face of this web is perfectly smooth and flat to act as a guide for the flat rear face of the separate casting. Lugs *B* and the U-shaped flange *C* are also formed between the die halves, and these parts, of course, clear the ends of the web *A*. The under faces of lugs *B* and flange *C* are cast flat and smooth to guide the front face of the separate casting which, when slid into place, makes a snug fit against the guiding faces. It is significant that no machining is required on the guiding faces or on the separate casting.

* * *

Machinery Exports Begin to Decline

The United States exports of industrial machinery for May, the last month for which complete statistics are available, were valued at $35,500,000, a decline of 11 per cent from the April figure of $40,960,000, according to the Department of Commerce. The May exports of machine tools reached the figure of $14,390,000, as compared with $19,020,000 in April. The May exports of milling machines amounted to $2,950,000; lathes, $2,415,000; drilling machines, $676,000; and grinding machines, $2,061,000.

Building Consolidated's Battleships of the Air

Second Installment of an Article Describing Production Methods in One of the World's Largest Airplane Manufacturing Plants

By PHILLIP KOENIG, Tool Supervisor
Consolidated Aircraft Corporation, San Diego, Calif.

OPERATIONS performed in the manufacture of two- and four-engine bombing planes for warfare over land and sea were described in an article published in July MACHINERY. This second installment presents several more operations in the same factory.

Gun carriage supports are being machined eighteen at a time on the LeBlond engine lathe shown in Fig. 12. The operation consists of facing a flat pad on the front side of these pieces while they are mounted on the faceplate and then finishing a channel groove that extends the full length of each part at a radius. The round nose tool seen lying on the tool-block is employed in finishing the channel, the width of which must be correct within plus 0.010 inch, minus nothing.

The groove is somewhat wider than the tool and it is the practice to feed the tool radially into the work-piece for cutting each side after the correct setting has been determined by means of a micrometer. The tool is fed sidewise slightly for finishing the bottom of the groove. Since this photograph was taken, a new tool-block has been provided for this machine which enables the round nose tool to be used both for finishing the groove and facing the flat outer pad.

Engine-mount holes are drilled and reamed in airplane oil tanks and the surface surrounding the holes spot-faced in the American radial drilling machine shown in Fig. 13. In this operation, the center distances between the holes, located in the four corners of the front side of the tanks, must be maintained within 0.003 inch, even though the center distances are 31 and 34 inches, respectively. This accuracy is insured by performing the operation with the oil tanks properly located in a jig.

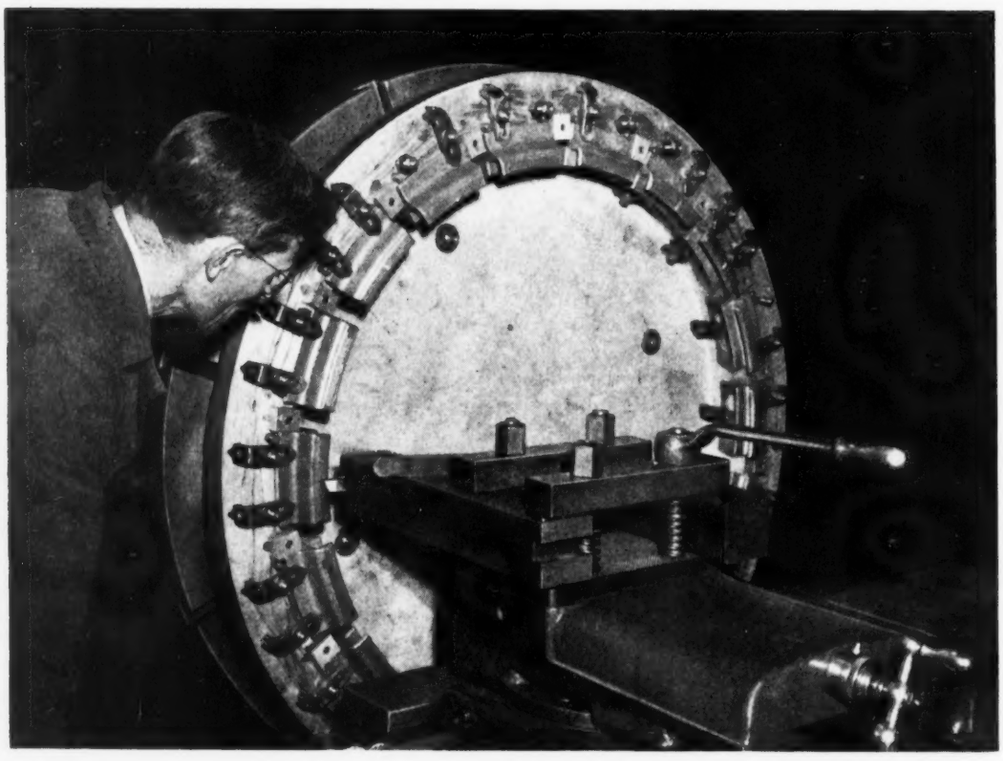
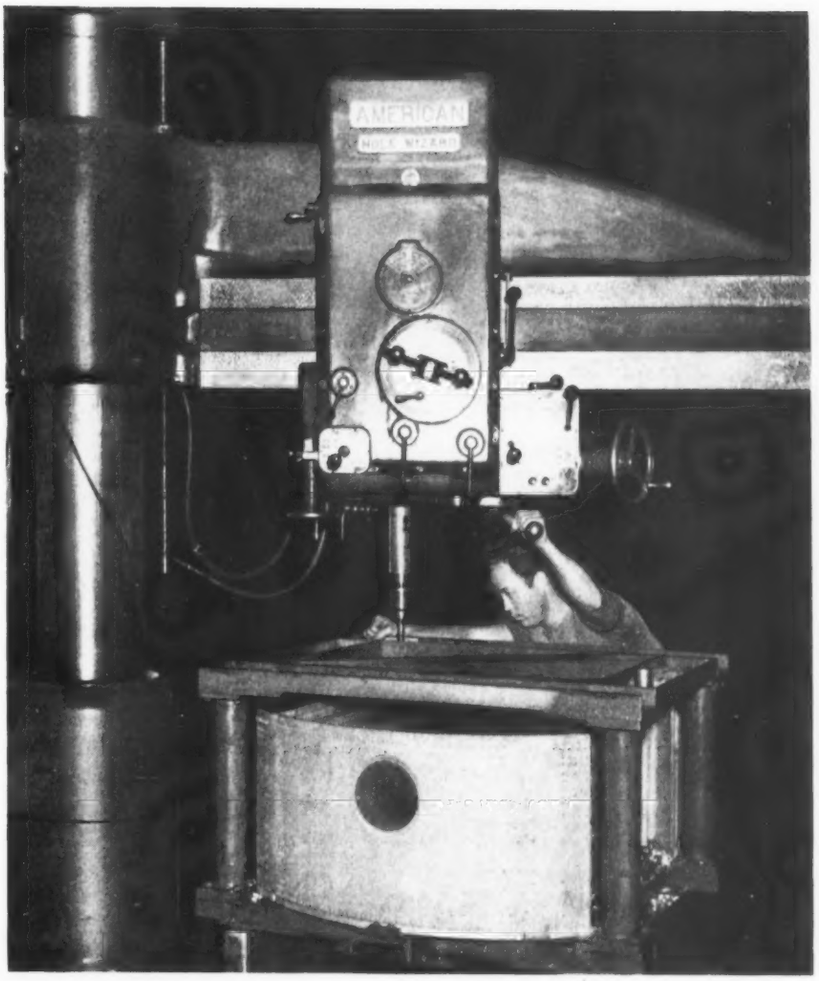


Fig. 12. Lathe Set-up in which Eighteen Gun Carriage Supports are Faced and Grooved at One Time

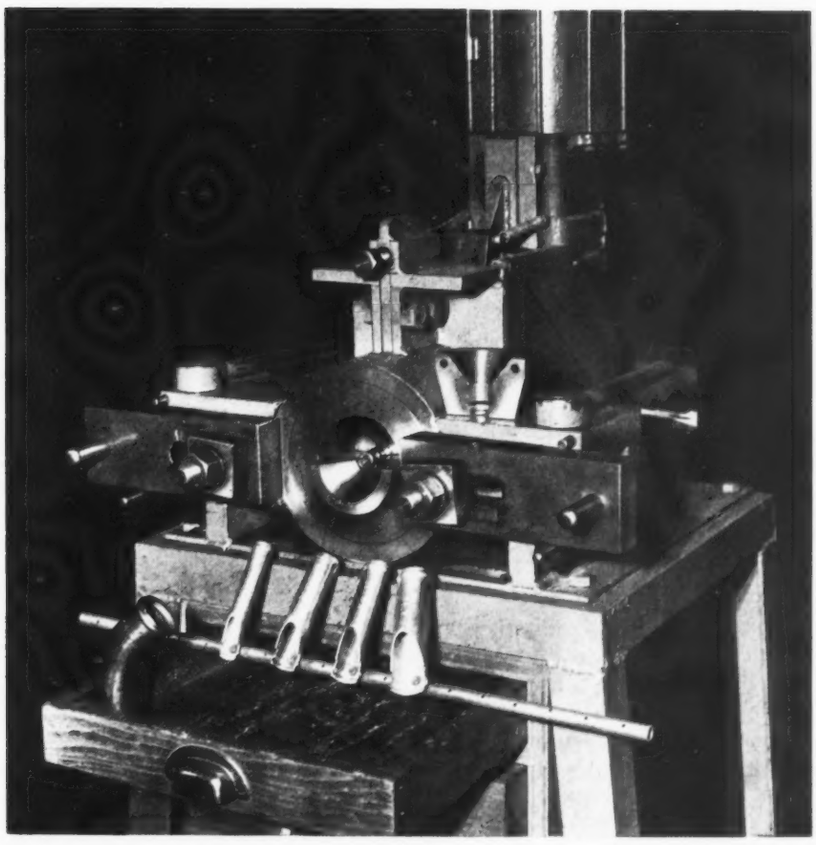
Fig. 13. Radial Drilling Machine being Employed for the Accurate Drilling of Engine-mount Holes in Large Airplane Oil Tanks



Replaceable bushings have been provided to suit the different steps of the operation.

A special machine designed for forming a bead in the ends of tubing is shown in Fig. 14. Typical examples of work may be seen lying on the table drawer, some of the parts being cut away at one end to illustrate the appearance of the beads on the inside of the tubes. Either stainless-steel or aluminum tubing can be handled.

In an operation, the tube is placed between the split dies and clamped in position. Only one die half is seen in the chuck, the other half lying on top of the machine. Extending through the center of the die halves, and therefore into the end of the tube to be beaded, is an air-operated ram which carries a ring of rubber between sliding and stationary members. When the sliding member of this ram is pulled back with the application of air pressure, the width of the rubber ring is compressed with the result that the periphery is expanded within the tube. This expansion of the rubber forces the outer wall of the tube into the cavity in the die halves and thus forms the bead. One of the die halves is then removed to enable withdrawal of the beaded tube.



A standard machine adapted to a special operation is shown in Fig. 15. This equipment consists of a Delco sensitive drilling machine set up on its back to bring the spindle into a horizontal position. Through the provision of a special tool and means of holding the work, this equipment is adapted to flaring the ends of tubes. The work-piece is clamped

Fig. 14. Special Machine Designed for Producing Beads in the Ends of Tubes through the Expansion of a Rubber Ring

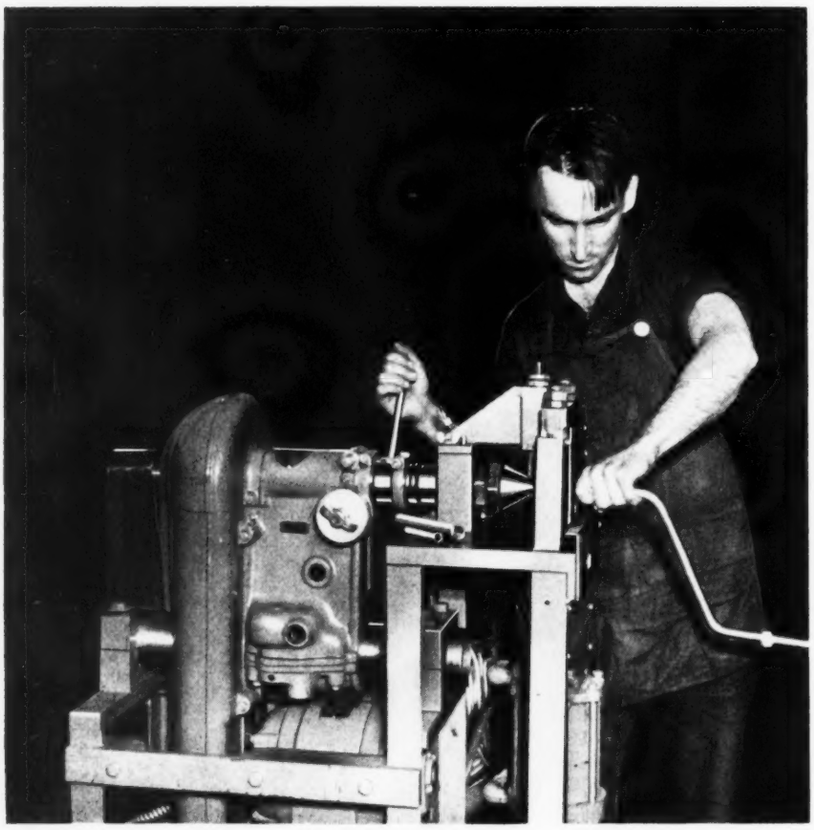


Fig. 15. Flaring the Ends of Aluminum-alloy Tubing on a Sensitive Drilling Machine Provided with an Eccentrically Revolving Tool

in position by means of a jaw that is raised and lowered through the action of an air cylinder. The air cylinder is actuated by depressing a foot pedal.

The operator advances a large conical tool into the clamped tube to do the flaring. This tool revolves eccentrically and thus gradually forces the end of the tube outward at an angle as the operator turns the feed handle. Only aluminum-alloy tubing is flared by this equipment.

* * *

If manufacturers should band together to coerce the Government, what would happen? There are other groups of men who do so freely, and gain their ends.

Beeswax Used to Facilitate Nailing of Hardwood

The use of beeswax to make nailing easier is an old practice. Carpenters frequently have a hole filled with beeswax in the end of the hammer handle for waxing the points of nails. A limited number of tests have been made at the Forest Products Laboratory of the United States Forest Service, Madison, Wis., to determine the effect of wax on driving characteristics and holding power.

It was found that even a small amount of beeswax on the points materially reduces the force required to drive nails, decreases the percentage of nails that bend in driving, and lessens the tendency to split the wood. However, it also reduces the holding power. Nails with waxed points driven through hardwood into softwood framing, when pulled shortly afterward, had about three-fourths of the holding power of nails with no wax on them. Several hours after driving, nails with waxed points had only slightly lower holding power than unwaxed nails, indicating that possibly over a long period of time the loss of holding power as a result of waxing may be small.

The tests on waxed nails indicated that the practice of waxing nail points is not an erroneous one, but has a definite value in making hardwood easier to nail, and that the benefits obtained from the use of wax, in almost every case, outweigh the loss in holding power.

Small Percentage of Fatal Accidents Occur in Industry

Last year, according to the National Safety Council, 96,000 people were killed through accidents in the United States. Frequently, well-meaning but uninformed people are inclined to blame industry for most fatal accidents, believing, as they do, that industrial machinery is particularly dangerous to life and limb.

It is therefore both of interest and importance to learn that of those killed in accidents last year, 35 per cent were killed in accidents on the public highways, 34 per cent were killed through accidents in the home, and 13 per cent were killed in other accidents in public places, recreation grounds, etc. This accounts for 82 per cent of all fatal accidents. Only 18 per cent were killed in industrial accidents.

What is even more noteworthy, however, is that of those working in industry only two suffered a fatal accident while engaged in their work to every three workers who were killed in accidents outside of working hours. Actually, therefore, an industrial plant proved to be the safest place for the worker to be in—far safer for him than the world outside. As a matter of record, considering only men and women working in industry, very nearly as many of them were killed by automobile accidents on the public highways as those who suffered fatal accidents while at work.

Redesigning Duplex Oil Pump for Welding

OFTEN relatively simple changes in design, made possible by welding, not only reduce the cost of a piece of machinery, but also increase its efficiency. This was the case with a pump that was designed for use in the Old Ocean Oil Field, the highest pressure field in the Texas Gulf Coast area, according to Professor H. B. Rigsby, of the Agricultural and Mechanical College of Texas, College Station, Texas. The conventional duplex pumps previously employed gave a great deal of trouble because of the complicated castings used and the extremely high pressure under which they were operated. It was difficult to keep the cylinders in accurate alignment; weak points in the castings often gave way; and interchangeable parts were hard to produce.

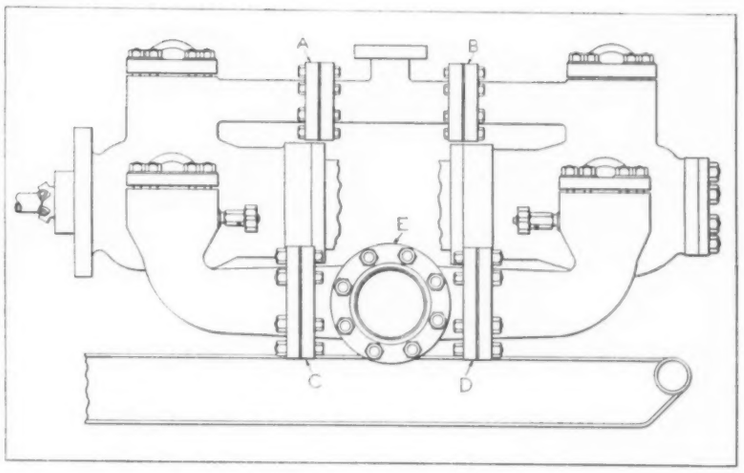


Fig. 1. Original Design of Duplex Oil Pump Showing Large Number of Flanged Joints Required

The new design, employing welded instead of flanged joints, greatly simplified the castings, made it possible to use standard fittings, and assured accurate alignment of the cylinders, with a resultant reduction in wear on packing and plungers. In addition, the machining time was greatly reduced and maximum interchangeability of parts was made possible.

The old design is shown in Fig. 1. The flanged joints *A*, *B*, *C*, *D*, and *E* were eliminated in the new welded design shown in Fig. 2. The cylinders were held in alignment during the welding operation by a heavy pipe machined to fit the cylinder bores, and positioning was done with a chain hoist. Under a hydraulic pressure of 10,000 pounds per square inch, there was no failure at any point during tests, and the pump was subsequently put into operation under a pressure of 1350 pounds per square inch. The cost of the pump as previously built was $6300, while the welded design cost $4600 and had a 20 per cent greater capacity.

* * *

Electric refrigerators in 1942 will have more than fifty plastic parts, according to a survey made recently by the Plastics Department of E. I. du Pont de Nemours & Co., Inc. The average number of plastic parts in 1941 electric refrigerators is thirty-nine. Refrigerator and plastics engineers have cooperated in developing a number of new applications for next year's models.

The increasing use of plastics is due to the fact that these materials offer the advantages of insulating value, economy, durability, attractive appearance, and resistance to rust in humid atmosphere. In addition to these advantages, the scarcity of aluminum, stainless steel, and brass caused by the Defense Program will accelerate the application of plastics, not only in refrigerators, but in a great many other applications as well.

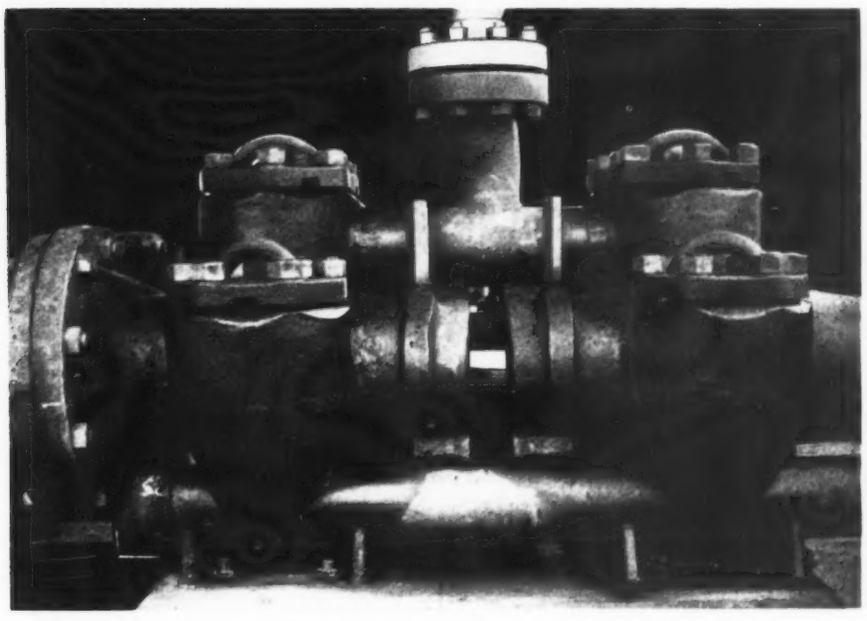


Fig. 2. Redesigned Duplex Pump Providing More Accurate Alignment of Cylinders and Eliminating Several Flanged Joints (Photo, Courtesy Hobart Brothers Co., Troy, Ohio)

Engineering News Flashes

A Forty-Ton Flywheel for a Mine 6000 Feet Deep

In two minutes, a load of 8 tons can be brought to the surface from a mine 6000 feet deep by means of an electric winder recently made by the British Thomson-Houston Co., Ltd., for the City Deep mines in South Africa. The single-piece flywheel, made from cast steel, which is part of each motor-generator set, weighs 40 tons. The 36-foot drums used in connection with this equipment are believed to be the largest ever made for electric mine winders.

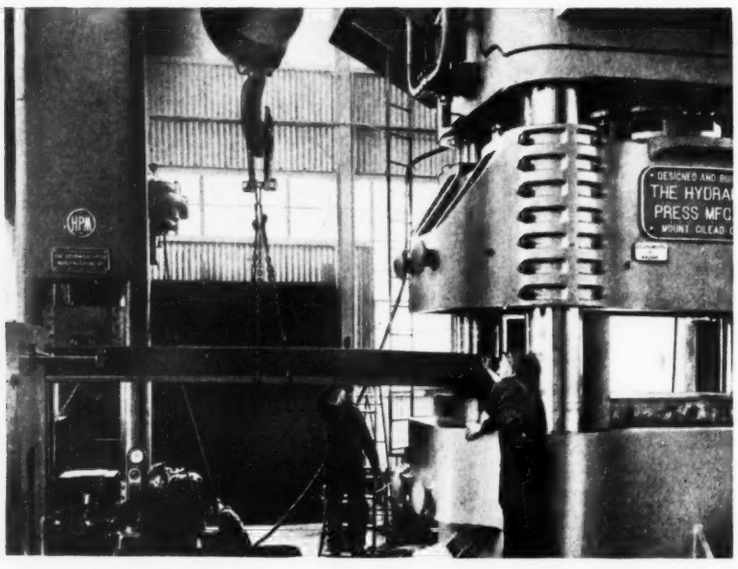
First All-Welded Nickel-Clad Steel Tank Cars Placed in Service

The first of five all-welded nickel-clad steel tank cars was recently completed by the American Car & Foundry Co., Milton, Pa. These cars are designed especially for carrying a variety of chemicals and other products whose color and purity must be protected against metallic contamination. All the tank seams are automatically welded by the "Union-melt" process on the outside, while the interior of the butt joints are welded manually with pure nickel electrodes to provide a complete all-nickel lining. All the welds were X-rayed to make sure of meeting the specifications of the Interstate Commerce Commission.

The cars are provided with 6 inches of spun glass insulation contained in an outer casing of steel. They are also provided with steam-heating coils buried in the insulation and coming in contact with the exterior of the tank proper, so that the contents may be heated, if necessary. The interior of the tanks are clad with nickel so that the cars can be used to carry phenol, solvents, a wide range of alkalies, syrups, and the like, without danger of metallic contamination. The nickel layer is rolled directly onto the steel in such a manner as to form a permanent bond. Each tank is 32 feet long, 86 inches in diameter, with flanged and dished heads. The capacity of the tank is 10,000 gallons.

Cleaning Drills in Tanks Provided with Electric Immersion Heaters

The time required for cleaning certain types of drills has been reduced to one-fifth in the plant of the Cleveland Twist Drill Co., Cleveland, Ohio, through the installation of two General Electric 5000-watt Calrod immersion heated tanks. In the process used for cleaning the drills, spots and stains are removed by rotating brushes and a brushing compound. This compound adheres to the drills and must be removed. It is for this purpose that the tanks heated by immersion heaters are used. The first tank contains a solution of potassium tallow soap kept just under the boiling point, and the second tank, water kept at nearly the boiling point. With this method it is possible to clean 3000 1/8-inch drills or from 4000 to 5000 1/16-inch drills per hour. The heaters in the tanks are controlled by thermostats and automatic time switches so that the solution and the water can be kept at a constant temperature.



Rubber Employed in a Press for Fabricating Airplane Parts. The Illustration Shows How, in a Newly Developed Method, a Pad of Rubber Weighing 4000 Pounds, is being Installed in a 5000-ton Press Built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, for a British Aircraft Factory. The Pad, Made by the B. F. Goodrich Co., is Over 14 Feet Long, 4 Feet 3 Inches Wide, and About 11 Inches Thick

The Hull of a 20-ton Bomber in the Glenn L. Martin Co. Works, in Baltimore, Md., is Swung by a Crane above the Enormous Aircraft Assembly Floor. These Bombers for the United States Navy are Delivered by the Martin Works at the Rate of More Than One Every Week

New Devices for Decreasing Vibration

Three new Vibro-Insulators, devices consisting of rubber and metal for decreasing vibration and noise in machinery installations of various types, have recently been developed by the B. F. Goodrich Co., Akron, Ohio. One of these insulators has been designed for a load in vertical shear of 80 pounds per square inch, a deflection in shear of 1 inch at a loading of 80 pounds, and a minimum disturbing frequency at this deflection of 470 per minute. In another type the rubber is applied only in compression, with the maximum loading 150 pounds per square inch, a deflection of 5/32 inch, and a minimum disturbing frequency at that deflection of 1200 per minute. The third type is best adapted for work where the rubber is in compression, although it may also be applied in shear. The maximum load limit is 100 pounds per square inch, and the minimum disturbing frequency, 1250 per minute.

Air-Conditioning the Offices of a Manufacturing Plant

The offices of the Wheeling Corrugating Co., New Orleans, La., covering 30,100 square feet, have been air-conditioned by the installation of a 10-ton self-contained Westinghouse air-conditioning unit used in conjunction with a direct-fired gas heater. This equipment maintains the temperature at about 75 degrees F. with 50 per cent relative humidity winter and summer. The air is recirculated every six minutes and fresh air is fed into the ventilating system at a rate which will provide a complete change of air once every hour.

The total annual cost for fuel, power, and water for this installation is estimated at slightly less than $900. In the summer, the monthly average is $83—about $54 for electricity and $29 for water. In the winter, the operating expense is much less, or a total of $27 a month—about $20 for gas and $7 for electricity. The low cost of heating in the winter is due to the fact that the winter months are comparatively mild in New Orleans.

The Automobile Industry as a Consumer of Farm Products

We do not generally think of the automobile industry as a consumer of farm products, yet that industry is a very large user of the products of the farm. According to D. U. Bathrick, general sales manager of the Pontiac Motor Division of the General Motors Corporation, the motor car industry uses 358,000,000 pounds of cotton annually; 16,640,000 pounds of wool; 2,800,000 bushels of corn, or its equivalent, for paints and varnishes; 590,000 bushels of flax for paints and soaps; 12,500,000 gallons of molasses (sugar cane) for solvents; 1,925,000 pounds of mohair (from Angora goats); 2,000,000 pounds of castor oil; 1,500,000 gallons of soy bean oil; 800,000 gallons of tung oil; and a great amount of leather for upholstery; not to mention glue and greases of organic origin.

Railroads Plan Huge Increase in Equipment

When the peak load on the railroads comes next October, the roads will have 168,000 new freight cars in service, in addition to 27,000 cars that have been rebuilt during the last two years. By October, there will also be in service approximately 1000 new locomotives — 375 steam and 625 electric and Diesel electric.

The Association of American Railroads has recommended to its members that an additional 120,000 new freight cars be acquired for the anticipated traffic in 1942, and a further addition of 150,000 cars for the traffic in 1943.

Is the Government Trying to Regulate Too Many Details from Washington?

Once a wise man said: "That government is best that governs least." Possibly Canada is giving a demonstration of this principle in the handling of her war industries production. In proportion to population, and certainly in proportion to pre-war industrial resources, Canada has accomplished, to date, more in the production of war materials than has the United States. Yet Canada has not found it necessary to "regulate" industry to such an extent as has our Government. It is open to question if we have not in this country gone too far in that respect.

Canada Gets Along with Less Red Tape Than We Do

In Canada there is no multiplicity of letters or numbers indicating degrees of "priority." When the Canadian Government realizes that it needs certain equipment or materials at a certain time, the manufacturer concerned is asked if he can promise delivery on a given date, and that settles the matter of priorities. The Canadian Government assumes that manufacturers and industry-groups know better than anyone else what should be done first in order to meet these delivery promises. Obviously, the manufacturer must assure himself, before making such promises, that he can obtain the required materials.

In the United States, the priority system has developed to such an extent that large manufacturing companies have found it necessary to set up separate expensive organizations to direct their activities in matters pertaining to priorities. In view of the enormous number of regulations that come out of the Division of Priorities in Washington, it is obvious that someone must be detailed to study and digest this material. The organization that has been set up by some manufacturers solely to take care of this new burden on American manufacturing enterprises presents to the company officials all orders and rules pertaining to priorities that have been promulgated by the Office of Production Management in Washington, as well as those promulgated by other government departments or regulating bodies, including the numerous Congressional and Governmental Committees.

Priority Regulations Increase Burden on Manufacturers

Such a priorities organization within a company also handles the application of priorities to the company's suppliers of materials. It helps the shop executives to obtain such information as will permit them to arrive at a correct decision in the case of conflicts of shop schedules between two or more orders bearing the same priority rating. For this information, of course, the company's priorities division must confer with various governmental agencies, since little is left to the judgment of the manufacturer himself, in spite of the fact that frequently, because of his knowledge and understanding of his product and its uses, he would be the man best fitted to render a decision.

The fact that manufacturing organizations have found it necessary to set up separate departments simply to deal with priority matters indicates how involved this phase is in our national set-up. Obviously, the ordinary citizen, especially when he is familiar with manufacturing procedure and the methods under which our large manufacturing organizations operate, asks himself whether all this is really necessary; and, furthermore, he wonders how Canada can get along without all this red tape when we cannot.

To try to govern the delivery of every machine from a Washington office presupposes such a top-heavy organization that it will fail to function satisfactorily because it is too cumbersome. Examples where Washington red tape has delayed rather than accelerated deliveries can be pointed out. Perhaps an outstanding example is that of a manufacturing concern that had urgently needed machine tools ready for shipment for over two months before the Washington rules and regulations could be untangled sufficiently so that the shipment could be made.

"Everything Takes so Long Now Because of the Emergency"

Such incidents bring to mind a story current in industrial circles relating to a manufacturer who submitted a bid to a department in Washington. For several weeks he received no response. Knowing that the equipment was needed in a hurry, he finally went to Washington himself. His complaint was investigated by an elderly civilian clerk who, after searching in several offices, finally located the respective bid and advised the manufacturer that while it had not been given consideration as yet, it would be acted upon in due time. "You see," he said, "everything takes so much longer now on account of the emergency."

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Pneumatic Drill Operating Mechanism

Several different types of valve-gear mechanisms are employed for the operation of pneumatic rock drills. One of these types, made by the Climax Rock Drill & Engineering Works, Ltd., Carn Brea, Cornwall, England, is shown in Fig. 1. This particular mechanism is used for a 3-inch anvil-block type hand hammer drill employed in the mining industry. The movements of the piston *A* are controlled by a spool valve *B*. The tool derives its name from the anvil *C*, which is interposed between the piston and the drill *D*. The particular drill shown has a shank of hexagonal cross-section. It is guided in the bushing *E*, which, in turn, is held in the tool-holder *F*.

The essential movements for rock drilling are an uninterrupted series of blows in rapid succession on the end of the drill, and a rotary motion of the drill, which must be turned a few degrees between successive blows. The blows, 1600 to 2200 per minute, are imparted by the piston *A* operating on the anvil block *C*, the velocity of the piston at the moment of impact being between 20 and 25 feet per second. The turning motion is imparted to the drill between successive blows by the helical-splined rifle bar *G*. This bar is engaged by a phosphor-bronze nut secured in the piston at *H*.

The rifle bar is provided with a ratchet mechanism at *J*, an end view of this mechanism being shown at *K*. The ratchet mechanism allows the rifle bar to turn in one direction only. On the return stroke of the piston, the ratchets prevent the rifle bar from turning, and in consequence, the piston turns a few degrees on the rifle bar in accordance with the helix angle of the splines. On the power stroke of the piston, however, the rifle bar is free to turn, and the piston moves forward without rotating, the inertia of the piston and the parts keyed to it causing the ratchet gear to slip.

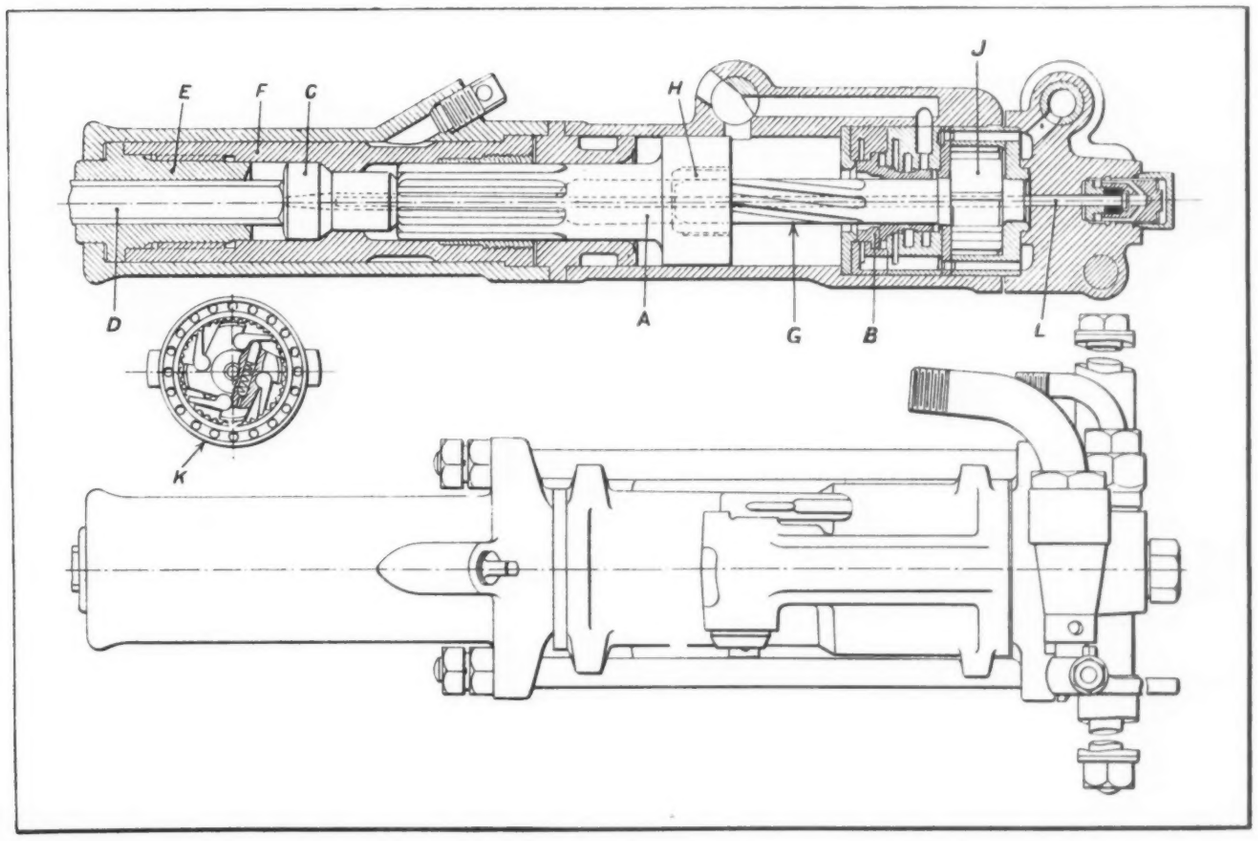


Fig. 1. Anvil-block Type Mechanism of Pneumatic Rock Drill

The piston is splined, and the splines are engaged by a nut in the tool-holder *F*. The turning movement of the piston on its return stroke, therefore, is transmitted to the tool-holder and to the drill.

Water or air is almost always required at the drill point to facilitate the removal of the rock fragments or chips. In consequence, the drill is usually hollow, so that air or water can be fed through it to the point from the tube *L* by way of the hollow anvil block, piston, and rifle bar.

Fig. 2 is a diagrammatic sectional view of the pneumatic drill, illustrating the operation of the spool valve. The top half section shows the valve in position for admitting air to the rear of the cylinder, while the bottom half section shows the valve in position for admitting air to the opposite side of the piston.

The action of the valve is as follows: With the piston *S* in its rearmost position, air is admitted through the passages *B* and port *C* to the cylinder, as seen in the top half section, to drive the piston outward. The valve *A* is locked in this position by the air pressure acting on its front face *L*, the area of the front face being larger than that of the rear face *M*, and both faces being subjected to the same air pressure.

On the outward stroke, when the rear edge of piston *S* uncovers the port *E* in the cylinder, air at cylinder pressure passes up through the passage *E* to a port in the valve box, and acts on the face *O* of the valve. This moves valve *A* to the left, closing port *C* and cutting off the air supply which serves to drive the piston outward. At the same time, the valve opens communication between the live air port *D* and the port and passages *H* permitting air to pass to the front of the cylinder and drive the piston back. Just before piston *S* delivers its blow, the rear edge of the piston uncovers the main exhaust port *G*, and the air behind the piston passes out to the atmosphere.

In the live air port *D*, there is a small face *N* on the valve, and the air pressure acts on this face, tending always to move the valve to the left. This serves to lock the valve in the position it takes up when air is being supplied to drive the piston back.

On the return stroke of piston *S*, when the rear edge has passed and closed exhaust port *G*, the remaining air in the rear of the cylinder is compressed until the pressure is sufficient to move valve *A* to the right, back to its initial position.

There is a front control port *F* in the cylinder, which is connected to the port *F* in the valve box. When the piston uncovers this port on its return stroke, air passes through the passage *F* and acts on the valve face *P*. This tends to move the valve to the right, but in ordinary running, the port *F* in the cylinder is inoperative, the compression pressure in the rear of the cylinder on the return stroke of the piston being the real cause of the movement of the valve. The purpose of port *F* in the cylinder is to prevent the piston from coming to rest with the main exhaust *G* slightly open to the front end of the cylinder, which would cause difficulty in restarting. On the return stroke of piston *S*, the main exhaust port *G* is uncovered before the piston is brought to rest, and the air in front of the cylinder exhausts to the atmosphere through this port.

As soon as the front end of piston *S*, in moving outward to deliver its blow to the drill, has closed main exhaust port *G*, there is a tendency for the air trapped in front of the piston to cushion the force of the blow delivered to the drill. This is, however, taken care of. Referring to the top half section of the illustration, it will be observed that when live air is being supplied to the rear end of the cylinder the front end of the cylinder has an opening to the atmosphere through passage *H*, the reduced diameter of valve *A*, and the port and passage *Q*. The air in front of the cylinder can therefore exhaust to the atmosphere, and cushioning of the piston prior to the blow is avoided.

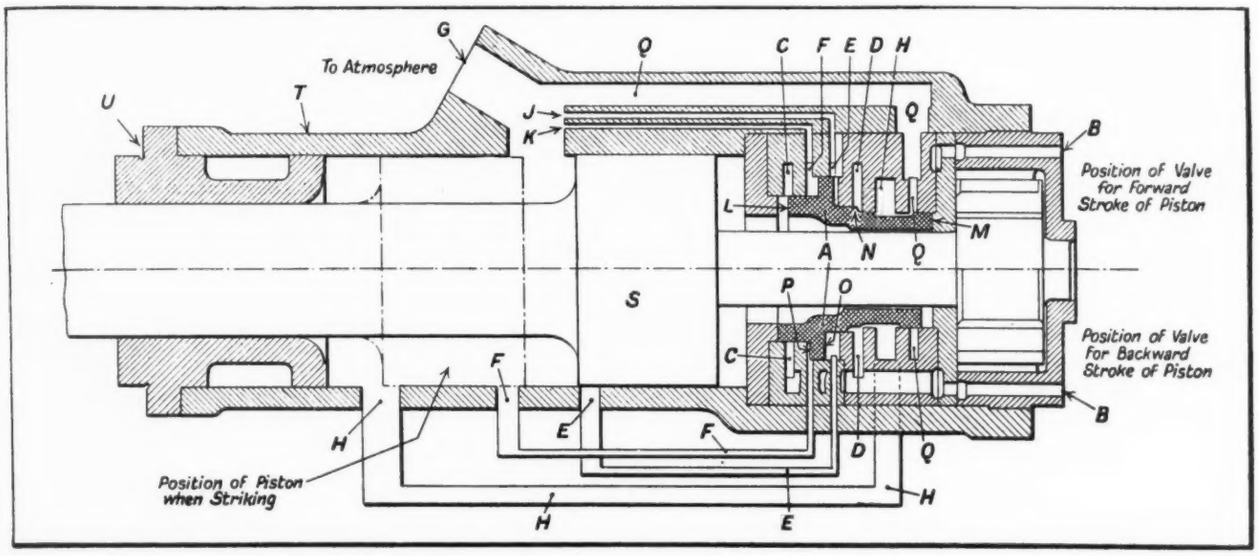


Fig. 2. Spool Valve Mechanism of Pneumatic Drill

It will be noted that the front air supply port *H* is partly covered when the piston is in position for striking the drill. This prevents damage to the piston in case the drill should be run without drilling actually taking place, or in the event that the operator does not hold the tool down to the work. When the piston passes port *H*, air is trapped between the front face of the piston and the face of the division ring *U*, and the resulting compression prevents damage to the division ring.

Two small exhaust passages *J* and *K* are controlled by the faces *O* and *P* of valve *A*. These passages insure that no residual air pressure will remain in ports *E* and *F* of the valve box after the valve has been moved to either end of its travel. The absence of residual pressure in these ports is essential for free movement of the valve.

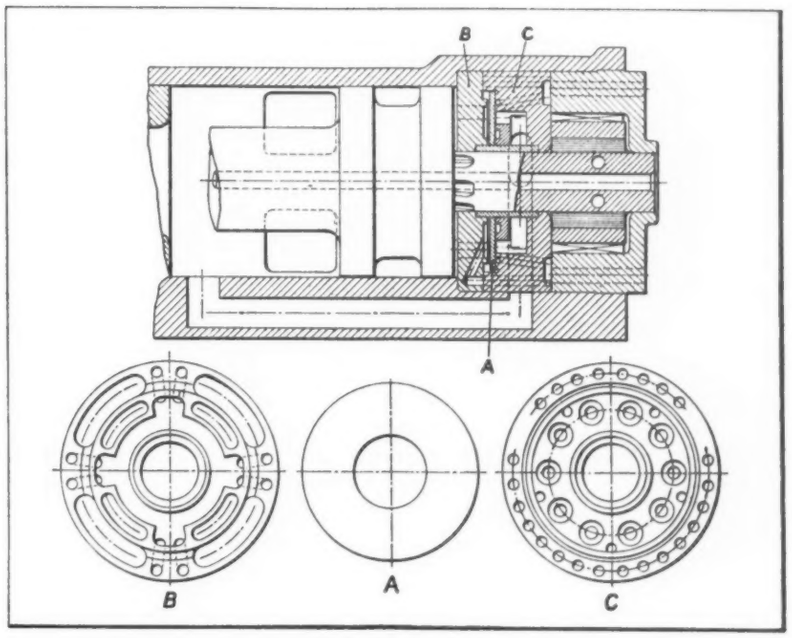


Fig. 3. Diagram Illustrating Operation of Disk Valve

Several other types of valve gear are employed. In the design shown in Fig. 3, the valve is of the disk type, the steel disk *A* operating between the valve seats *B* and *C*, and performing the same duties as the spool valve previously described. In this type of design, there is a hole through the center of the valve and seats to permit the passage of the rifle bar. B. M.

Training Welders on a Large Scale

By J. R. MORRILL
The Lincoln Electric Co., Cleveland, Ohio

THE writer was very much interested in the article in July MACHINERY, page 215, entitled "Success of State Trade Schools' Emergency Training Courses." A number of the Connecticut trade schools have done good work in connection with arc welding. The change-over from riveted design to arc-welded design in ships, tanks, and machinery has expanded the arc-welding industry so rapidly that only an almost overnight expansion of training facilities throughout the country made it possible to obtain a sufficient number of welding operators.

In addition to the state and municipal vocational training schools, a great many privately conducted welding schools have been largely responsible for an adequate supply of skilled arc welders. One of the first, if not the first, organized welding schools was the Lincoln School of Arc Welding, operated as far back as 1917 for the purpose of training Army men in the then mysterious technique of arc welding, which was used for the repair of artillery field equipment. The Lincoln school has been in continuous operation ever since and is the oldest school of arc welding in existence. Even during the depression the growth of the welding industry continued steadily, so that the school remained in constant operation with two classes a day. At the present time four classes a day keep the school operating for the full twenty-four hours.

The fact that there are many young men who are willing to work from midnight to six o'clock in the morning in order to learn a trade indicates the stamina and ambition of American youth. It disproves the statement so often made that American boys are not willing to learn a trade and look only for white collar jobs.

The regular course keeps each student busy six hours daily, five days a week, for a period of four weeks. Approximately 240 men graduate from this course every month and immediately find jobs as welding apprentices or "tack" welders. After a remarkably brief period of experience on the job, they become first-class qualified welders. A nominal charge of fifteen dollars is made for the four weeks' course. Up to the present time approximately 15,000 men have graduated from the Lincoln welding school in twenty-four years.

Improvements that Facilitate Thread Cutting

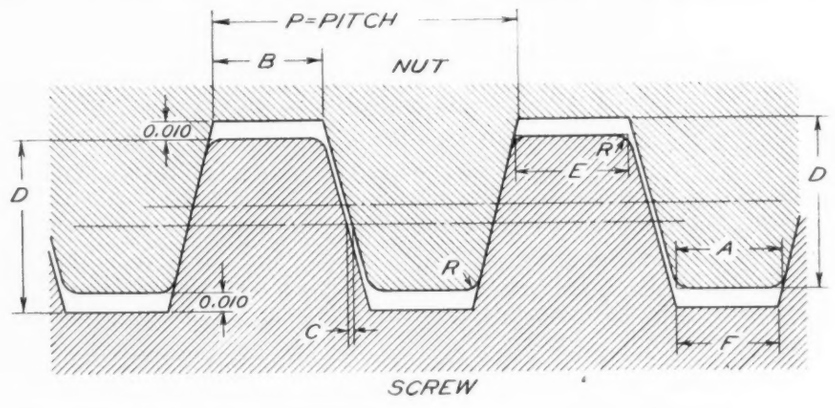
Suggestions for Improvements in Thread Forms and Thread-Cutting Practice that will Result in Better Threads and Greater Accuracy in Thread Cutting

By C. REIMSCHISSEL, Engineer
Landis Machine Co., Waynesboro, Pa.

IN 1933, the National Screw Thread Commission decided upon tolerances for Acme threads. These tolerances covered not only the pitch diameter, but also the major and minor diameters, as in the National Coarse and National Fine thread practice.

When cutting Acme threads with a die-head using the present National screw thread tolerances, the head is closed down to the minimum pitch diameter. Should the part to be threaded be a valve stem or similar part having a cylindrical portion in front of the thread, as shown in Fig. 1, then the crest of the thread on the chasers will form a shallow thread groove on the plain cylindrical part, if the diameter of this is equal to the basic minor diameter of the screw or even slightly less. The diameter of the cylindrical portion should not be larger than the minimum minor diameter,

Table 1. Dimensions for Acme-Thread Nuts and Screws with Close, Medium, and Loose Fits



Nut			Screw		Screw (Close Fit)			Screw (Medium Fit)			Screw (Loose Fit)			Pitch
A	B	D	D	R	C	E	F	C	E	F	C	E	F	P
0.1853	0.1801	0.2600	0.2600	0.0312	0.0050	0.1803	0.1851	0.0100	0.1753	0.1901	0.0150	0.1703	0.1951	0.5000
0.1483	0.1431	0.2100	0.2100	0.0250	0.0040	0.1443	0.1471	0.0080	0.1403	0.1511	0.0120	0.1363	0.1551	0.4000
0.1236	0.1184	0.1767	0.1767	0.0208	0.0033	0.1203	0.1217	0.0067	0.1169	0.1241	0.0100	0.1136	0.1284	0.3333
0.1059	0.1007	0.1529	0.1529	0.0179	0.0029	0.1030	0.1036	0.0057	0.1002	0.1064	0.0086	0.0973	0.1093	0.2857
0.0927	0.0875	0.1350	0.1350	0.0156	0.0025	0.0902	0.0900	0.0050	0.0877	0.0925	0.0075	0.0852	0.0950	0.2500
0.0824	0.0772	0.1211	0.1211	0.0139	0.0022	0.0802	0.0794	0.0044	0.0780	0.0816	0.0067	0.0757	0.0839	0.2222
0.0741	0.0689	0.1100	0.1100	0.0125	0.0020	0.0721	0.0709	0.0040	0.0701	0.0729	0.0060	0.0681	0.0749	0.2000
0.0618	0.0566	0.0933	0.0933	0.0104	0.0017	0.0601	0.0583	0.0033	0.0585	0.0599	0.0050	0.0568	0.0616	0.1667
0.0530	0.0478	0.0814	0.0814	0.0089	0.0014	0.0516	0.0492	0.0029	0.0501	0.0507	0.0043	0.0487	0.0521	0.1429
0.0463	0.0411	0.0725	0.0725	0.0078	0.0013	0.0450	0.0424	0.0025	0.0438	0.0436	0.0038	0.0425	0.0449	0.1250
0.0412	0.0360	0.0656	0.0656	0.0069	0.0011	0.0401	0.0371	0.0022	0.0390	0.0382	0.0033	0.0379	0.0393	0.1111
0.0371	0.0319	0.0600	0.0600	0.0063	0.0010	0.0361	0.0329	0.0020	0.0351	0.0339	0.0030	0.0341	0.0349	0.1000
0.0309	0.0257	0.0517	0.0517	0.0052	0.0008	0.0301	0.0265	0.0017	0.0292	0.0274	0.0025	0.0284	0.0282	0.0833
0.0265	0.0213	0.0457	0.0457	0.0045	0.0007	0.0258	0.0220	0.0014	0.0251	0.0227	0.0021	0.0244	0.0234	0.0714
0.0232	0.0180	0.0412	0.0412	0.0039	0.0006	0.0226	0.0186	0.0012	0.0220	0.0192	0.0019	0.0213	0.0199	0.0625
0.0206	0.0154	0.0378	0.0378	0.0035	0.0006	0.0200	0.0160	0.0011	0.0195	0.0165	0.0017	0.0189	0.0171	0.0555

Close Fit: $C = 0.01\ P$; Medium Fit: $C = 0.02\ P$; and Loose Fit: $C = 0.03\ P$

but, preferably, equal to the minimum minor diameter minus 0.005 inch. Since work of this kind is frequently met with and since the plain cylindrical part is often used as a seal, such as a bearing for a packing gland, the present National tolerances for Acme threads are objectionable.

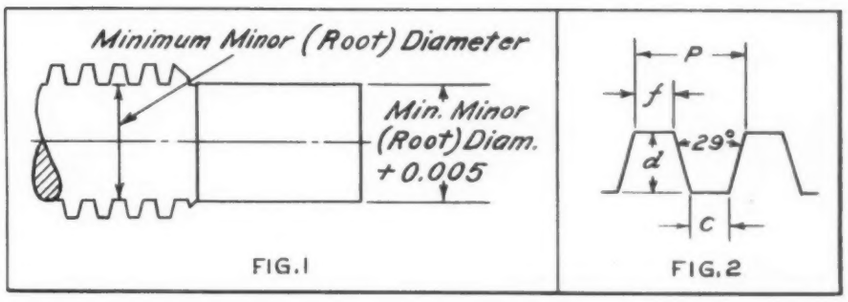


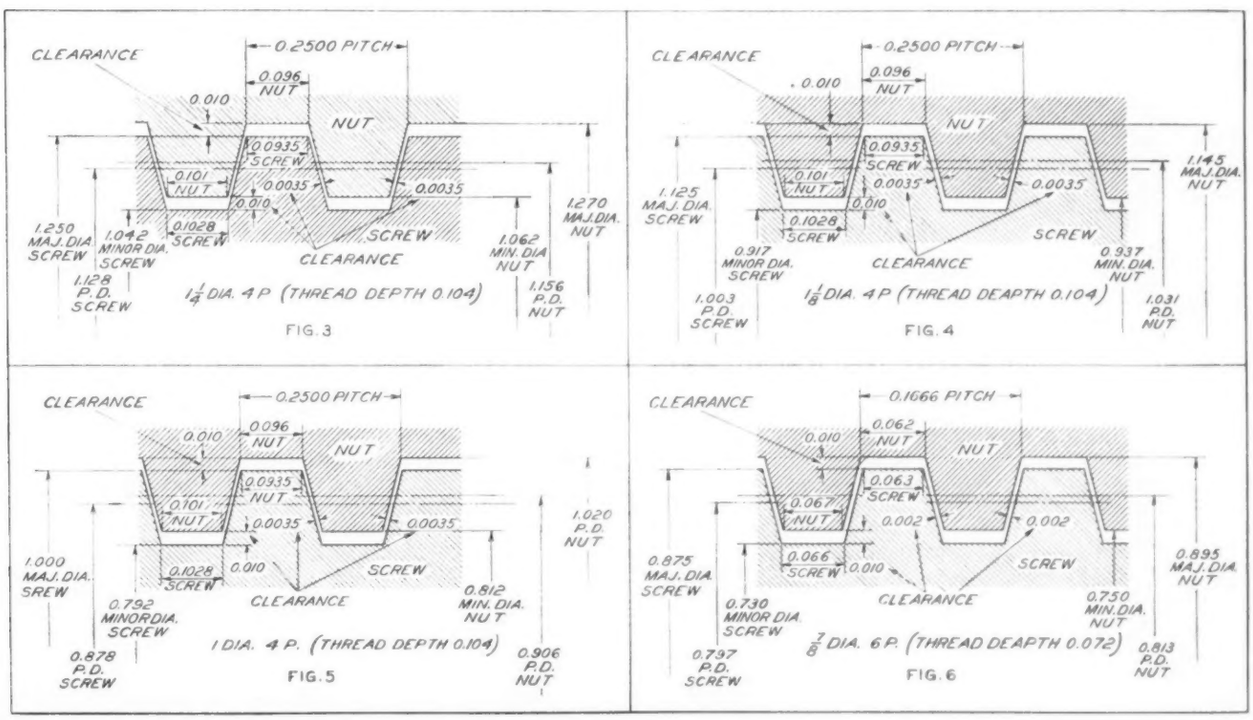
Fig. 1. Acme Thread where the Diameter of the Cylindrical Portion in Front of the Thread is Slightly Greater than the Minimum Minor (Root) Diameter of the Thread, which Causes the Crest of the Thread on the Chasers to Form a Shallow Thread Groove on the Plain Cylindrical Part. Fig. 2. Modified Form of Acme Thread (See Text in Article for Values of Dimensions)

A common difficulty with the Acme form of thread is to obtain a free fit and yet maintain the major and minor diameters. In many applications of Acme threads, the major diameter must be maintained because it is used as a bearing for a collar or other part that it must fit. The use of Acme threads for that purpose is justified, since the wide flat crest of the thread offers a good bearing support.

Obtaining interchangeability is another difficulty in the use of Acme threads. The general practice in the past, still in use in many plants, has been to make the taps to basic dimensions and then to make the screw fit the tapped nut. Where gages were used, they were made to basic dimensions without "Go" and "No Go" limits. Thus, male and female gages were both made to the basic dimensions; and, of course, the nuts were tapped and the screws were cut to the respective basic gage. This resulted in working fits, but always at the expense of using closer tolerances than necessary.

The Acme thread, after all, takes its bearing under pressure on one flank of the thread only; and since the thread is made with a basic major and minor diameter, the tolerance for obtaining the fit can be secured by placing it all on the flanks or side angles of the thread. It should be remembered that the clearance between the root and crest of an Acme thread is rather liberal since it amounts to 0.010 inch. Therefore, to obtain a free fit, if the tolerance is all on the side angle, a more practical form of thread is obtained, in that the depth of engagement will always be constant and the working tolerance will be limited merely to the side angles.

In Table 1 is shown a suggested outline of an Acme thread, based on side clearance, dimensions for which are tabulated under close, medium, and loose fits. The dimensions given are such that the nut retains its basic standard form, while the clearance is obtained by decreasing the thickness



Figs. 3, 4, 5, and 6. Modified Forms of Acme Threads Used on Valve Stems

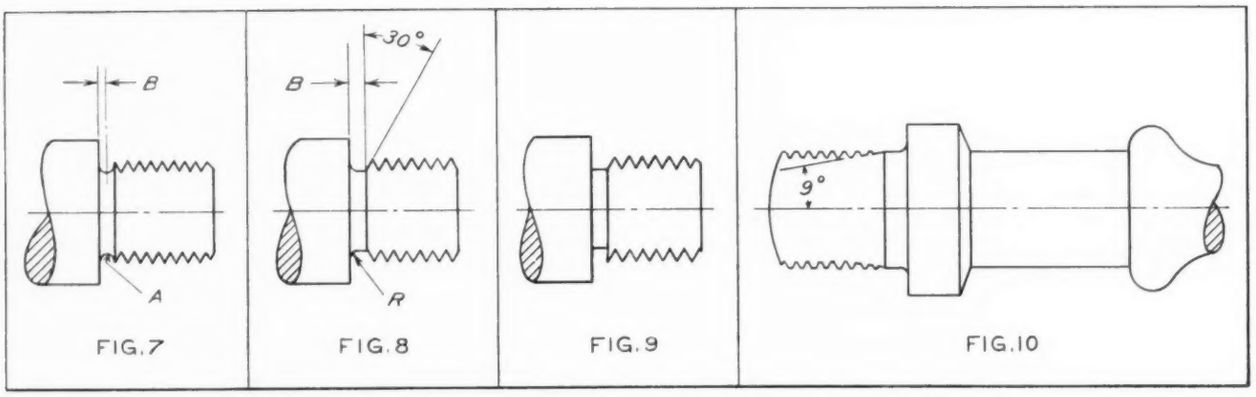


Fig. 7. Objectionable Form of Clearance at End of Thread. Fig. 8. A Preferred Form of Clearance. Fig. 9. Common Practice of Using a Square Groove as Clearance. Fig. 10. Design of Sucker Rods Using a 9-degree Angle on the Chasers for Cutting the Thread

at the pitch line of the thread on the screw. This is a practical solution, since interchangeability can be maintained where the nut has been tapped to the basic size. The clearance C is obtained by multiplying the pitch by 0.01 for a close fit; by 0.02 for a medium fit; and by 0.03 for a loose fit. A slightly rounded corner is shown at the crest of the thread on both the screw and the nut, as at R. This eliminates the sharp corner and makes a better appearing thread.

The medium and loose fits are recommended for valve stems, jack-screws, and in work where a slight end play between the nut and screw is not objectionable. The close fit is recommended for screws that must have a minimum amount of end play, such as feed-screws for machine tools. There has been no effort made to show working tolerances of the screw, but the table shows the basic dimensions to which taps and chasers should be made.

In many cases, the Acme form is used not for its strength, but rather for obtaining a screw with a coarse pitch to provide rapid advance in engagement. Both the standard Acme screw and nut are expensive to manufacture, but the cost can be decreased by using a modified form of thread, such as is shown in Fig. 2. The dimensions for this thread are based on the following formulas:

For screws:

$$d = (0.375 \times P) + 0.010 \text{ inch};$$
$$f = 0.40302 \times P;$$
$$c = (0.40302 \times P) - 0.0052 \text{ inch}.$$

For taps:

$$d = (0.375 \times P) + 0.020 \text{ inch};$$
$$f = (0.40302 \times P) - 0.0052 \text{ inch};$$
$$c = (0.40302 \times P) - 0.0052 \text{ inch}.$$

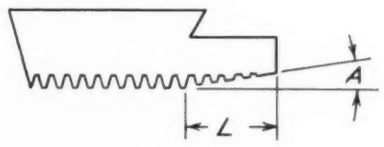
Jack-screws for automobiles and other forms of lifting screws are, in many cases, made only one-half of the standard depth of the Acme thread. This makes for more economical manufacture and has the further advantage that the root diameter of the screw is greatly strengthened by being increased due to the shallow thread.

Figs. 3, 4, 5, and 6 show a modified form of thread used on valve stems in which the major and minor diameters can be held to the basic size, while all the tolerance is obtained on the side angle of the thread. Threads designed in this way are economical to manufacture and do not have to be inspected on the minor and major diameters. In fact, the gages for work of this kind can be limited entirely to the side angles of the thread.

One of the most expensive difficulties in cutting Acme threads with a die is due to the fact that designers seldom allow enough space for the imperfect threads produced by a chaser throat which is sufficiently long to properly distribute the chip and to obtain an efficient cutting action of the chaser. Unless the throat is of proper length, the

Table 2. Lengths of Chaser Throats for Acme Standard Threads

Throat Starting 0.010 Inch below Root of Thread



L, Length of Throat

Threads Per Inch	A, Angle of Throat, in Degrees						
	7	9	10	12	15	20	30
16	0.417	0.323	0.290	0.241	0.191	0.140	0.088
14	0.453	0.351	0.315	0.262	0.207	0.153	0.096
12	0.502	0.389	0.350	0.290	0.230	0.169	0.106
10	0.570	0.442	0.397	0.329	0.261	0.192	0.121
9	0.615	0.477	0.428	0.355	0.282	0.207	0.130
8	0.671	0.520	0.467	0.388	0.307	0.226	0.142
7	0.744	0.577	0.518	0.430	0.341	0.251	0.158
6	0.841	0.652	0.585	0.486	0.385	0.283	0.179
5	0.977	0.757	0.680	0.564	0.447	0.329	0.207
4	1.181	0.915	0.822	0.682	0.541	0.398	0.251
3 1/2	1.326	1.028	0.923	0.766	0.607	0.447	0.282
3	1.520	1.178	1.058	0.878	0.696	0.513	0.323
2 1/2	1.791	1.389	1.247	1.035	0.821	0.604	0.381
2	2.198	1.704	1.531	1.270	1.007	0.741	0.467

chaser cannot produce the best finish, nor have maximum life. For single Acme threads, cut in steel, the chaser throat angle should not be more than 12 degrees to properly distribute the cut. A 10-degree throat angle is more efficient, but is generally used only in conjunction with a lead-screw.

In all threading dies, when the throat or "chamfer" has too many imperfect threads and the die-heads are fed onto the work by hand, there is always the danger that the first, second, or even the third threads of the work will be shaved off before the work has advanced into that section of the chaser which controls the lead. For double Acme threads, such as 1/4-inch pitch, 1/2-inch lead, a 10- or 9-degree throat angle is recommended; a triple thread requires a 7-degree angle for a fair distribution of the cut.

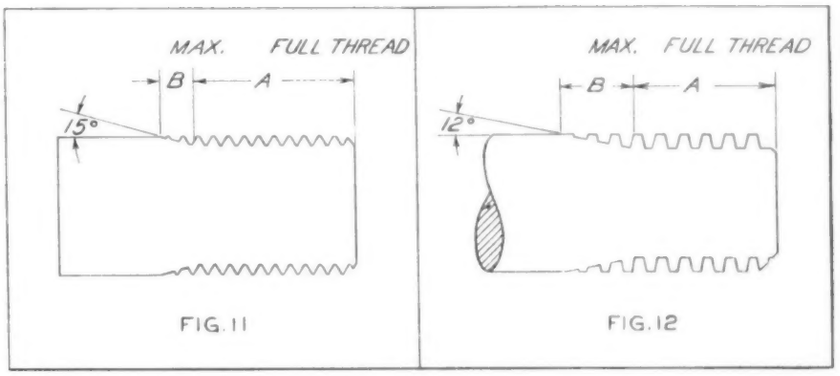


Fig. 11. Recommended Practice for Dimensioning Thread Lengths
Fig. 12. Practice of Dimensioning Thread Lengths on Acme Screws

Table 2 shows the lengths of the chaser throat for a range of from 16 to 2 Acme standard threads per inch. The chamfer starts 0.010 inch below the root of the thread. Table 3 shows the lengths of throats for these same threads per inch when the chamfer starts at the root of the thread. For general work, it is recommended to use, whenever possible, a throat or chamfer starting slightly below the root of the thread, so that on work where the chaser must remove metal from the outside of the screw blank, the throat can properly remove the excess metal.

Judging from many drawings issued by the Ordnance Department, the cutting of threads with dies was not contemplated when the designs were made. It appears to be a common fault of the Ordnance Department to limit the amount of relief or clearance at the end of the thread to the pitch of the thread, or in some cases to even less than the pitch. This is an expensive and impractical method when the threads are cut with the die-head, which, after all, offers the most economical method. Unless the threads have a reasonable clearance, it is often necessary to cut them by more expensive and slower methods, such as thread milling, cutting with single-point tools in a lathe, or grinding.

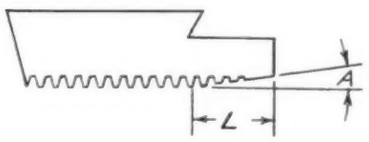
When it is necessary to use a very narrow clearance at the end of the thread, this should never be done as illustrated in Fig. 7, in which a fillet is shown on both sides of the under-cut for clearance. The radius *A* limits the actual width of the clearance that can be used for the throat of the chaser to dimension *B*, rather than to the full width of the groove, because the fillet interferes with the gages passing over the imperfect threads which would be left if the throat were made the full width of the groove.

Where it is necessary to have a fillet in the corner of the clearance groove to increase the strength of the part, it is good practice to make the clearance as in Fig. 8. It will be noted that the fillet *R* here is against the shoulder, and that a 30-degree angle is shown on the last imperfect thread on the work. The 30-degree angle has a decided advantage in that it eliminates the ragged part of the thread. With this type of clearance, the full width *B* of the groove is available for the throat of the chaser. Fig. 9 shows a common practice of using a square groove. This produces a sharp imperfect thread at the end. It can be improved by using an angle at the end of the thread, as shown in Fig. 8.

The American Petroleum Institute sucker rods now use a 9-degree angle where the thread leaves off, which, of course, corresponds to the throat

Table 3. Lengths of Chaser Throats for Acme Standard Threads

Throat Starting at Root of Thread



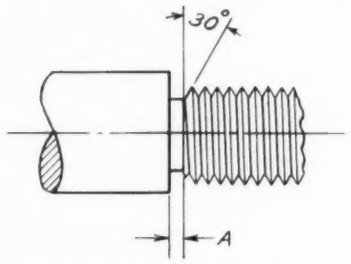
L, Length of Throat

Threads Per Inch	A, Angle of Throat, in Degrees						
	7	9	10	12	15	20	30
16	0.335	0.260	0.234	0.174	0.154	0.113	0.071
14	0.372	0.288	0.259	0.215	0.170	0.125	0.079
12	0.421	0.326	0.293	0.243	0.193	0.142	0.089
10	0.488	0.378	0.340	0.282	0.223	0.164	0.103
9	0.534	0.414	0.372	0.308	0.244	0.180	0.113
8	0.590	0.457	0.411	0.341	0.270	0.199	0.125
7	0.663	0.514	0.461	0.382	0.303	0.223	0.141
6	0.759	0.589	0.529	0.438	0.348	0.256	0.161
5	0.895	0.694	0.623	0.517	0.410	0.302	0.190
4	1.099	0.852	0.765	0.635	0.503	0.370	0.233
3 1/2	1.245	0.965	0.867	0.719	0.570	0.420	0.264
3	1.439	1.115	1.002	0.831	0.659	0.485	0.306
2 1/2	1.710	1.325	1.190	0.988	0.783	0.577	0.363
2	2.117	1.641	1.474	1.223	0.970	0.714	0.450

angle of the chaser (see Fig. 10). It is worthy of note that before the Institute standardized on this type of sucker rod, there were many losses and expensive shut-downs due to the use of a full thread up to the shoulder. The vibration to which these rods are subjected was the cause of fatigue failures at the shoulder. Since adopting the design shown in Fig. 10, failures of sucker rods through breaking at the end of the thread are practically unheard of.

The American Standards Association allows 2 1/2 imperfect threads at the end of the thread on bolts having the American National form of thread. This is equivalent to a 15-degree throat angle on the chasers, as shown in Fig. 11, which is satisfactory for this form of thread.

Table 4. Relief or Clearance for American National Form and Whitworth Form Threads



Threads Per Inch	A, Width of Under-Cut, Inches			
	Amer. Natl. Form		Whitworth	
	20° Short Throat	30° Short Throat	20° Short Throat	30° Short Throat
32	3/32	1/16	3/32	1/16
30	3/32	1/16	....	....
28	3/32	5/64	3/32	5/64
27	3/32	5/64	....	....
26	3/32	5/64	3/32	5/64
24	7/64	5/64	7/64	5/64
22	....	....	7/64	5/64
20	1/8	3/32	1/8	3/32
18	1/8	3/32	1/8	3/32
16	9/64	7/64	9/64	7/64
14	5/32	7/64	5/32	7/64
13	11/64	1/8	....	....
12	3/16	1/8	11/64	1/8
11 1/2	3/16	1/8	....	....
11	13/64	9/64	3/16	9/64
10	13/64	9/64	13/64	9/64
9	15/64	5/32	15/64	5/32
8	1/4	11/64	1/4	11/64
7	9/32	3/16	9/32	3/16
6	21/64	7/32	21/64	7/32
5 1/2	23/64	15/64	....	....
5	25/64	1/4	25/64	1/4
4 1/2	7/16	9/32	27/64	9/32
4	31/64	5/16	15/32	5/16
3 1/2	35/64	23/64	17/32	23/64
3 1/4	37/64	3/8	37/64	3/8
3	5/8	13/32	5/8	13/32

The widths given are necessary for full thread and allow nut to engage against shoulder. When work does not require under-cut, the dimensions given equal the length of imperfect threads plus approximately 1/32 inch. Whenever possible, a 20° throat should be used. The 20° throat is longer than the 30° throat, thus dividing the chip over a longer cutting edge and producing a better finish on the thread. The dimension *A* is 1/32 inch plus length of chaser throat.

A troublesome expression in connection with threads is "length of thread." What is meant by it? For example, many drawings call for a thread length of 1 inch. Now, does this mean 1 inch of full thread, or does it include the part where the thread leaves off? The recommended practice for dimensioning thread lengths is shown in Fig. 11. The *A* dimension is the length of full thread. If it is necessary to limit the *B* dimension, then this dimension should be given, but the dimension *B* when given would always be understood to be the maximum. The same applies to Acme threads, as shown in Fig. 12. Both dimensions *A* and *B* should be given, especially when *B* must be held to a limited dimension.

Table 4 shows the relief or clearance for a range of threads from 32 to 3 per inch American National form and Whitworth form, which is necessary when using a 20- or 30-degree short throat chaser for shoulder work. Narrow clearances requiring more than a 30-degree throat should not be used. If throat angles greater than 30 degrees are used, the threads on the work must be formed by the first thread on the chaser, which results in rough threads and high tool costs.

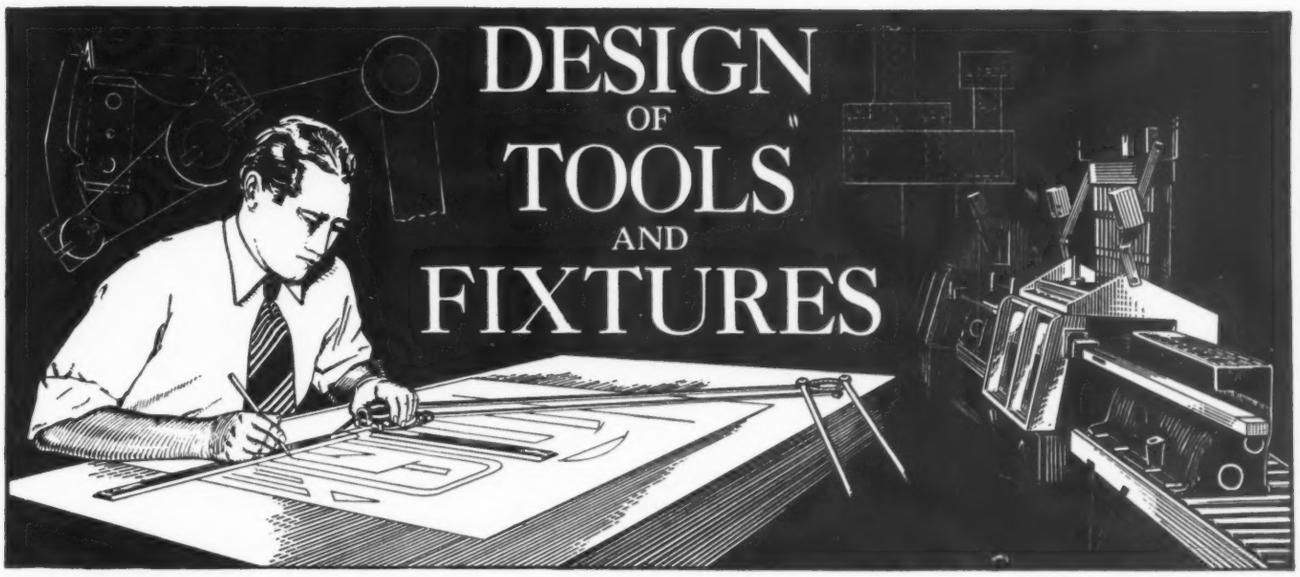
On airplane bolts, a common practice is to show a very narrow clearance, requiring the use of a 45-degree throat-angle chaser, a practice which weakens the bolt. A much stronger bolt could be produced if two or three imperfect threads were allowed. This would not impair the thread accuracy and would greatly reduce the threading cost.

By observing the foregoing suggestions, it would be possible to cut many threads by less expensive methods than is otherwise possible, and yet obtain the same degree of accuracy, fewer tool failures, and longer tool life.

* * *

South American Built Machine Tools to be Sold in the United States

According to information received from Cleveland, machine tools made in Buenos Aires, Argentina, and Sao Paulo, Brazil, are for sale in the United States through the Lempco Products, Inc., Cleveland, Ohio. This company has made arrangements to serve as exclusive American and British distributor for five machine tool manufacturing concerns in Argentina and Brazil. The first shipment of machine tools to arrive in the United States, believed to be the first South American made machine tools ever imported into this country, includes shapers, drill presses, punch presses, die filing machines, and hand screw machines—forty-seven machines in all. Additional shipments are expected to arrive in the United States from time to time. It is said that turret lathes, heavy-duty drill presses, and milling machines will be built and imported at a later date. The machines are being sold to manufacturers of war material and to educational training institutions.



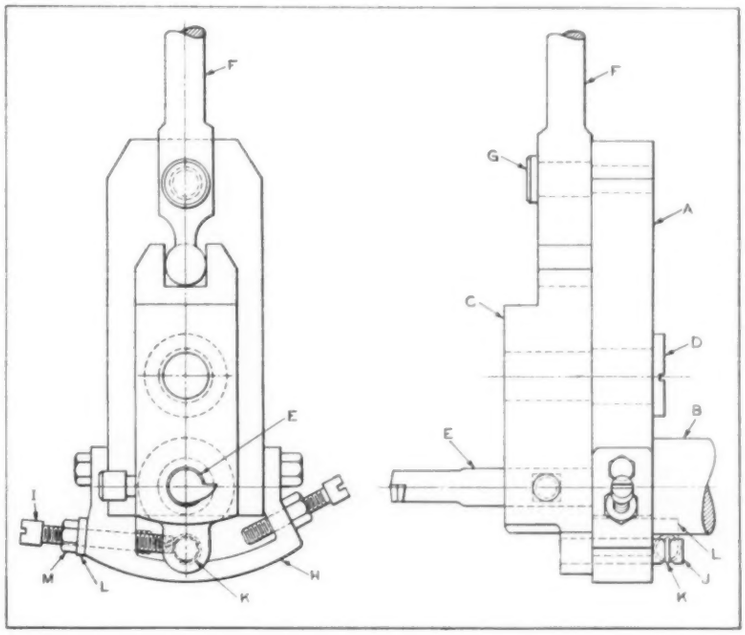
Recessing Tool for Turret Lathe

By GEORGE WILSON, Mankato, Minn.

The accompanying illustration shows a recessing tool designed for use in a turret lathe. The tool is employed for cutting a V-shaped groove in the bore of a piece to receive a wire ring that serves as a bearing retainer. A shank *B* which fits the turret is pressed into a hole in the mild steel body *A*.

Block *C* is pivoted on the shoulder of screw *D* on body *A*. A hole is provided in the lower end of block *C* to receive the shank of tool *E*, which is held in place by a set-screw. The shank of tool *E* is aligned with shank *B*. The upper end of block *C* is slotted to receive the end of a hand-lever *F* that is pivoted on shoulder screw *G*. Hand-lever *F* is knurled on the handle portion, not shown.

Yoke *H* is attached to body *A* and is provided with stop-screws and lock-nuts *I* which engage pin *J*, pressed into the lug on block *C*, for gaging the depth of cut and for locating the tool in the central or retracted position shown. After the recessing operation, the tool is returned to the central position, where it is held inoperative by coil spring *K*, which has one end hooked about pin *J* and the other hooked through a hole in the plate *L*, held under lock-nut *M*.



Recessing Tool Operated by Handle F and Provided with Shank B for Mounting in Lathe Turret

Fixture for Use in Assembling Oil Tanks by Welding

By JOSEPH WAITKUS, Wellsville, N. Y.

When welding is employed in the construction of a product, it is frequently desirable to provide a fixture to facilitate the assembling operation. Such a fixture can serve two purposes. It locates each part properly, and thus insures greater uniformity in the product; it also aids the welder by enabling him to concentrate on the welding operation.

The fixture shown in Fig. 2 is used to assemble the oil tank illustrated in Fig. 1. The tank consists of flange *A*, shell *B*, and bottom plate *C*, which, together with two bosses *D*, comprise the parts to be welded into a unit. All of the parts are premachined.

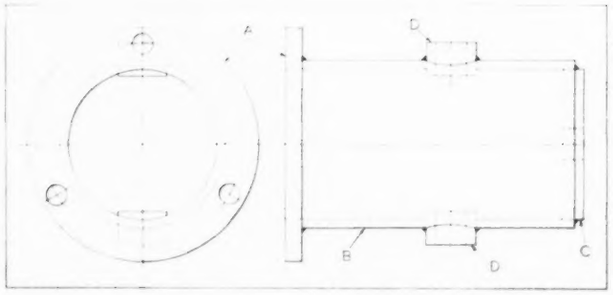


Fig. 1. Oil Tank Assembled by Welding

Flange *A* is finished and drilled; shell *B* is bored for the two bosses *D* which are, in turn, bored for a pipe tap; and bottom plate *C* is machined to fit into shell *B* and is also bored for a pipe tap previous to the welding operation.

The fixture, Fig. 2, has an angle *E* welded to a baseplate *F*. A supporting rod *G* extending from the angle is retained in position by a nut *H*. Collar *J*, shrunk on shaft *G*, provides a larger supporting surface for bottom plate *C*. A thrust washer *K* rests against a shoulder on shaft *G* and permits free rotation of the shaft.

In order to locate each of the tank parts in its proper relative position, an internal spacer is provided, which consists of a bar *L* to which two tubes *M* and *N* are fastened. Two plugs *O*, each machined to fit into the hole bored in the bosses *D* are also fitted to holes in bar *L*. A bar *P*, fastened to tube *M*, serves as a combined support and centering device for flange *A* and shell *B*. Bar *P* is provided with a pin *Q* which fits into the bolt holes in flange *A* and serves to lock the flange holes in a definite position relative to bosses *D*. The entire internal spacer assembly is fitted to shaft *G*. A handle *R* on shaft *G* is used to clamp the tank parts firmly together.

In performing the assembling operation, the welder first slides bottom plate *C* on shaft *G* until it rests against collar *J*. Shell *B* is next placed in position on bottom plate *C*, and flange *A* is held in place over the end of shell *B*. The internal spacer assembly is then slid into position on shaft *G* until it supports one end of the shell and centers flange *A*. With pin *Q* resting in one of the bolt holes in flange *A*, bar *L* is easily located inside shell *B*.

By holding flange *A* steady, the shell can be turned until the holes provided for bosses *D* are in line with the holes in bar *L*. Plugs *O* are then placed in the holes in bar *L*, and the bosses, in turn, are placed over the plugs. In this manner, the bosses are lined up with the holes in flange *A*, and, at the same time, are properly spaced. Handle *R* is then turned on rod *G* to clamp the parts in place.

The fixture is so designed that, in tightening handle *R*, the thrust is against bosses *D* on plugs *O*, thereby holding them firmly in place. Since shaft *G* is free to turn in angle *E*, the welder can rotate the whole tank as he performs the welding operation. An additional support for the tank, in the form of a bar *S*, is provided.

Chain Serves as Jig in Drilling Line of Holes on Curved Surfaces

A drill jig of novel design comprising a chain of accurate pitch, fitted with casehardened steel rollers having grooves in their peripheries, so that adjacent rollers form a circular tool guide, as indicated at *A* in the accompanying illustration, has been developed recently by the Renold & Coventry Chain Co., Ltd., Didsbury, Manchester, England. The chain jig is designed for use as a flexible drilling jig on simple curved and flat surfaces with which the chain can be held in contact along its whole length. Aircraft frames, tanks, and boilers are samples of work on which the chain can be employed to advantage in laying out, punching, or drilling holes.

The hardened-steel rollers are free to revolve on the chain bushings and take up a new position at each setting, thus reducing wear to a minimum. When the chain is to be used for drilling operations, the pitch *B* is selected to give the required spacing of the holes, and, for this purpose, each

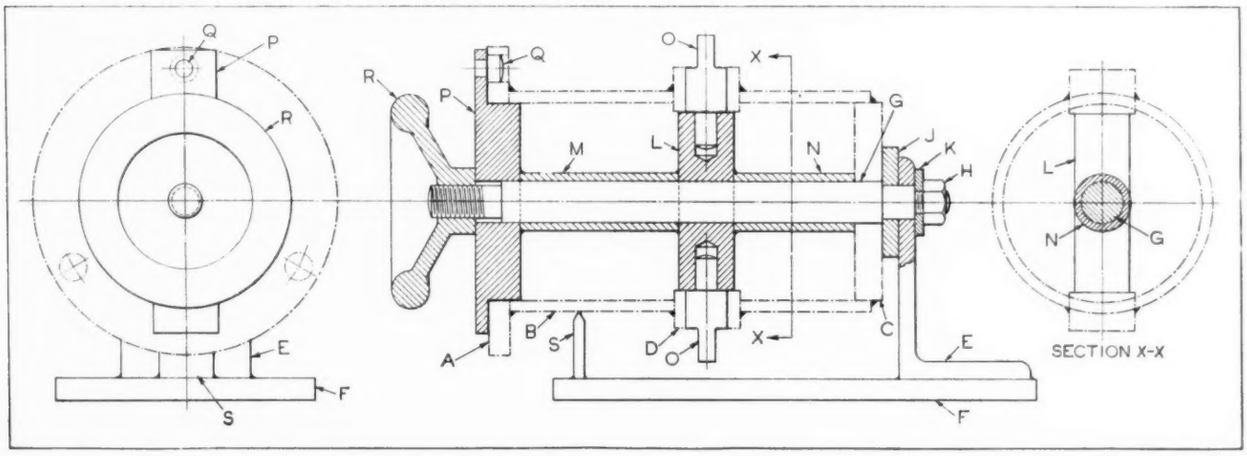
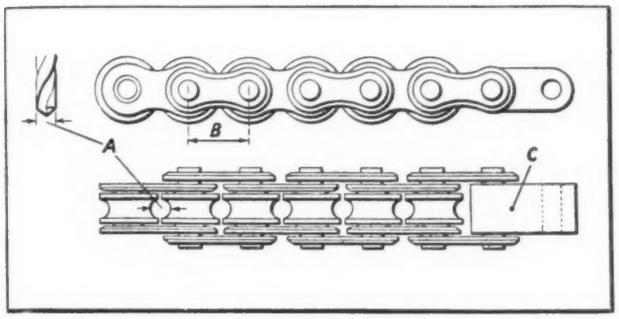


Fig. 2. Welding Fixture Used in Assembling Oil Tank Shown in Fig. 1



Jig Chain Used in Drilling Evenly Spaced Holes for Rivets

chain has an identification block *C* stamped with the pitch and drill size. The diameter of hole *A* formed by adjacent rollers corresponds, of course, to the diameter of the drill to be used.

The chain is secured to the fixture and tightened on the work by means of a draw-bolt and block, or other attachments which can be supplied. Thus, in addition to guiding the drill, the chain serves as a clamp for holding the work in position. Considerable flexibility is thus afforded, and several sizes of aircraft ribs, for example, can be accommodated in a single fixture by merely adjusting the height of the chain anchorage members. Standard chains are made for hole pitches ranging from 0.375 to 1.0 inch, and drill or punch diameters from 0.098 to 0.257 inch. B. M.

Grinding Work-Support Blades for Centerless Grinders

By STANLEY PORRITT, Philadelphia, Pa.

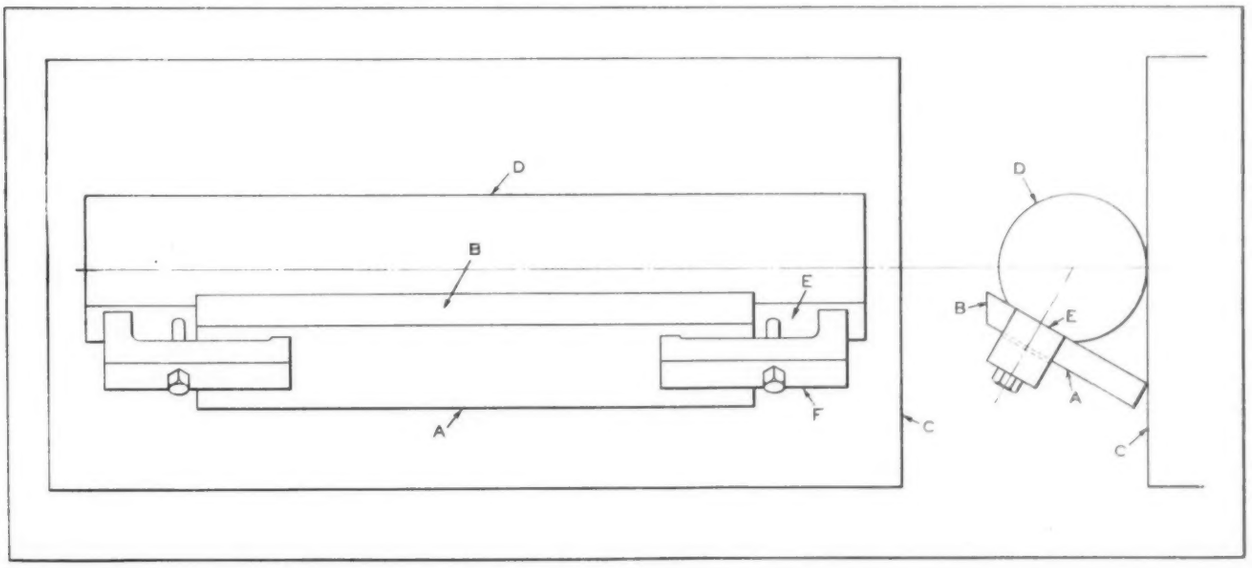
Work-support blades like the one shown at *A* in the accompanying illustration are used on centerless grinders. These blades are usually about 18 inches long and, when worn, the angular surface *B* upon which the work rides must be reground smooth, true, and parallel to the base on which the blade rests when in use. In small shops, it is unusual to find an adjustable angle-plate wider than 6 inches on which the blades can be set up for grinding. Grinding the tough chilled iron, Stellite- or Carboloy-faced blades with the ends unsupported usually results in badly warped inaccurate work.

The jig shown in the illustration was designed for use in grinding these blades, but it can also be used for grinding other work of a similar nature. The jig consists of a bar *D*, which is of heat-treated S A E 3140 steel, 2 1/2 inches in diameter, ground straight and parallel, with a flat *E* of sufficient width for clamping purposes and a row of tapped holes and the necessary clamps *F*. This simple jig can be made at a lower cost than almost any kind of adjustable angle-plate of a similar size.

When in use, the base of the blade rests on the magnetic chuck *C*, being fully supported and properly located to insure parallelism of the base and angular surface. The blade is clamped to the bar and is also supported sidewise, so that heavier cuts can be taken without causing the work to warp. It is infinitely adjustable in angular settings, and duplication of angles can be made by setting with a protractor between the sides of the blade and the face of the magnetic chuck.

* * *

The year 1940 was the first year in which the total amount of nickel used in trucks and buses exceeded that in passenger cars. This was due partly to the increase in production of heavy-duty units which use higher alloy percentages, and partly to the greater amount of nickel alloy steel used per truck. About 23 per cent of the nickel produced is consumed by the automotive industry.



Jig for Use in Grinding Work-support Blades for Centerless Grinders

Fabrication of Machine Bases by

THE large bases for Lester injection molding and die-casting machines, manufactured by the Phoenix Machine Co., Cleveland, Ohio, are being rapidly and economically produced by Steel Fabricators, Inc., Cleveland, Ohio. These bases, completely arc-welded from plate and bar stock, form a rigid and substantial support for the machines of which they are an important part. They also provide, within the base, a large tank for the oil required in the hydraulic system by which the machine is operated.

Bases of this kind are made in different sizes, but the one shown in the accompanying illustrations measures approximately 32 by 45 by 154 inches over all. Most of the structure is formed from 3/8-inch boiler plate, but some 1/2-inch and a few pieces of 1/4-inch boiler plate are employed. Bar stock 1 inch thick and 8 inches wide is used to form the main bosses, or platform, against which the massive yoke of the machine proper is later bolted. When complete, an average base weighs about 4000 pounds and includes a tank for 150 gallons of oil. All joints are arc-welded and are subsequently peened with an air hammer. The peening, with the normalizing which follows, effectively removes the stresses set up in welding. Good appearance, an important factor in the finished base, is also obtained by the fabrication methods employed.

Fabrication is begun by shearing plates to the required size and bar stock to the lengths needed. Nearly all cuts are straight and readily made on a shear, but a few pieces of irregular shape are cut with an oxy-acetylene flame. Certain sections of some bases are cut away with a flame, after assembly by arc welding has been partly or fully completed. Large hand holes are cut in a similar manner.

Fig. 2. False Bottom, which Forms Top of the Oil Tank of the Machine Base, being Welded to the Main Frame after Tubes Required in the Hydraulic System have been Welded into Holes in the Horizontal Plate

As will be seen by reference to the illustrations, the upper edge of the base is rounded and there is a return bend where the plates are joined to the 1- by 8-inch bar stock. This shaping requires that the plates be formed before welding starts. All forming, except for four small corner pieces, is done on a brake, using V-shaped dies having straight edges, shifting the work about 1/2 inch between strokes of the brake. A templet is used to check the radii on the work. The end plates are formed in this way on three edges, giving the base rounded vertical corners, as well as providing the return bend at the horizontal corners. Careful measurements are made on each piece formed to insure parallelism when the subsequent welding is done. All welding is performed with the work mounted on a large faceplate in order to eliminate twisting of the assembly and to insure that the machine will set square when it is installed on a level floor.

Assembly starts with setting up and clamping the two formed end plates and the two formed side plates in their correct relative positions on the face-

Fig. 1. Parts for the Base of a Die-casting Machine, Including the Two End and Two Side Plates which were Formed in the Press Brake Shown in the Background

the Arc-Welding Method

By HERBERT CHASE

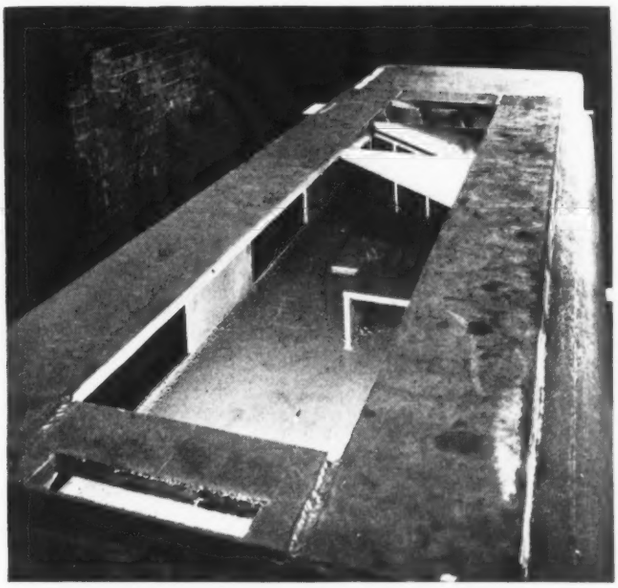


Fig. 3. Top View of Machine Base Showing V-shaped Welds in the Top Frame (Made from 1- by 8-inch Bar Stock) and the Interior Gussets and Strengthening Supports, as well as Pads for Mounting Hydraulic Units

plate. About 1/8 inch space is left between the edges to be joined by welding, the edges being cut square. This makes it possible to feed the welding rod between the plates and to effect a strong weld over the full depth of the joint. Four vertical welds, extending the full height of the base, serve to fasten the two ends to the two sides. Small gusset plates shaped to the correct radius are then put in place at each corner and are welded to the mating parts at their lower edge. These plates are then heated with a torch and hammered by hand to conform with the curved surfaces they must join, after which the remaining edges are welded.

Most of the top of the base is fabricated by joining bar stock 1 inch thick by 8 inches wide in such a way as to form a frame of oblong shape. This involves four welds at the ends of the shorter lengths. Because of the thickness of this stock, V-grooves are cut to provide for V-shaped welds. The top frame is then tacked in place against the upper edges of the assembled end and side plates, after which the horizontal joints are arc-welded, working first from the outside and then from the inside.

The assembly is now ready to receive the false bottom, which is really a horizontal partition about half way up the height of the base and which forms the top wall of the oil tank. This plate, together with some gusset plates, stiffens the assembly and is placed in position after inverting the base, when it becomes more readily accessible. After being tacked in place, this plate is welded to the sides and ends around its entire periphery. The intermediate plate is cut to such size that a 1/8-inch gap is left all around to facilitate welding over its full thickness. Some holes have previously been punched in the plate to receive short lengths of pipe required in the oil-circulating system. These pipes are next welded into the holes. After assembling gusset plates, small frames welded from bar stock are placed at the several openings that were previously flame-cut in the side and end plates. These frames are welded to the plates and provide a tapped stiffening flange for subsequent assembling of removable covers.

To one end of the main base is welded a base for the motor that actuates the machine. This motor base is made up from a section of 3/8-inch stock about 12 inches wide formed to a U-shape, as required. The ends of this piece are welded to one end of the main frame. Gusset plates are added at each side to strengthen the assembly, after which a top plate is put on. These parts and two strips 1 inch thick, which form bosses on which the motor rests, are arc-welded into a rigid structure capable of supporting the heavy driving motor.

The assembly is then ready for the bottom plate, which is welded in place in the same way as the intermediate plate but positioned only 1 inch above

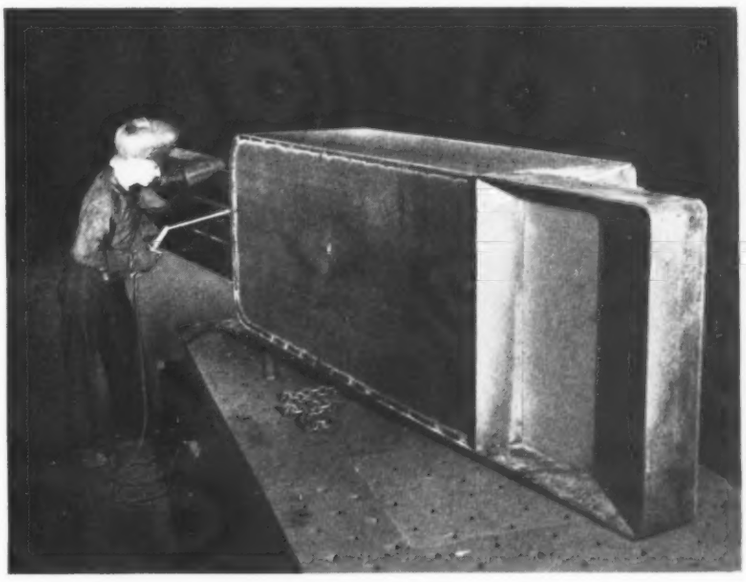


Fig. 4. Welding-in the Bottom Plate. This Plate Forms the Bottom of the Oil Tank. At the Right End of the Base is Seen the Extension Support for the Driving Motor

the bottom of the base. This completes the major part of the structure, except for the addition of a few minor parts, such as a strip of 3/8- by 3-inch stock that forms a finish band entirely around the base. This strip is welded in place, and besides providing a finished appearance, stiffens the lower edge of the assembly.

Several short blocks of 3- by 4-inch stock are also added at intervals around the base, each of these having a flame-cut slot or recess to make it possible to insert pinch bars to facilitate handling. Some stiffening plates are also added between the intermediate plate and one end of the top frame where much weight has to be supported. Top and side openings afford access to the interior where the welding is done.

This completes the welding operations, all of which are performed by the use of a 400-ampere Lincoln arc-welding machine, using No. 7 coated rod 1/4 inch in diameter. The rate of welding varies, naturally, with the position and thickness of the welds, but the average rate is high, as most of the welds are readily accessible. In all, about one hundred man-hours are required for the complete fabrication of the base, including the time for cutting and forming the plates, about twenty-eight hours consumed in the welding itself, and the time for setting up and clamping the plates and turning the base to facilitate the welding. Fabrication also includes the work of peening, chipping, and grinding after welding.

The total time required has been reduced to about one-third that needed in fabricating the original base, as the workmen have become more experienced in performing the necessary operations. At present, about twelve bases are fabricated a month, but the work is not continuous as the jobs are fitted in with others handled in the plant.

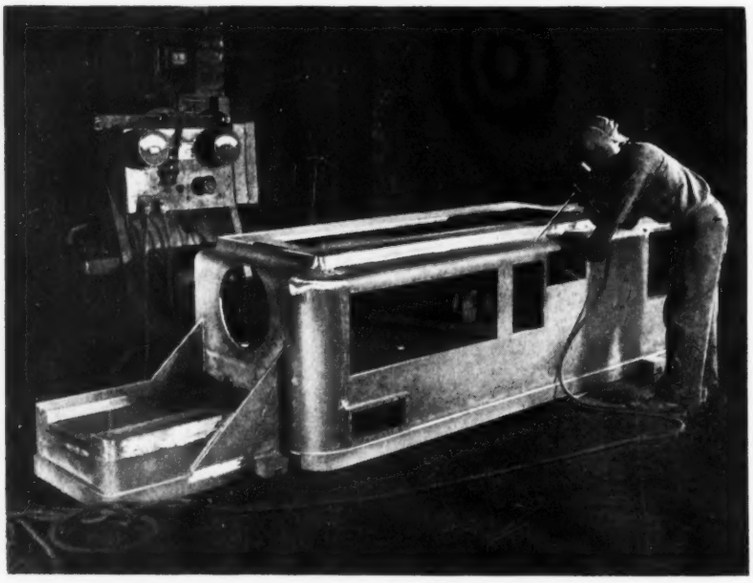


Fig. 5. Welded Machine Base in Substantially Completed Form, with Holes Flame-cut in the Sides and Ends and with the Finish Strip and Block Extensions Added at the Bottom of the Base

Normalizing is done in another plant equipped with the large ovens needed. The sand blasting which follows normalizing is also performed in another plant. The base is then delivered to the machine builder, who does such machining as is needed, the chief operations being to plane off the bottom edge of the base and the top face pads to receive the main frame of the machine. The base is lighter than a cast base would be, but has ample strength and stiffness, and, of course, requires much less machine work besides saving the cost of pattern equipment. A cast base would have to be made with the tank portion separate and would necessitate machining at the joint between the two parts. As may be seen in Fig. 5, the appearance of the welded die-casting machine base compares favorably with a machine having a cast base. In fact, when the machine is completely assembled, it appears as having been cast in one piece.

* * *

Some of the Properties of Magnesium

In recent years, magnesium has become a most important metal, not only because of the fact that it is lighter even than aluminum, but also because it has many other properties that make the metal especially suitable for construction work where a light metal is required.

Magnesium is found widely distributed in Nature in a number of different combinations, especially in the form of silicate and carbonate, and occurs in the minerals hornblende, talc, asbestos, and many others. It is manufactured on a large scale in various places. A feature of magnesium is brilliant light incident to its combustion, and it is, therefore, used for flashlights in photography, in signaling for naval and military purposes, and for fireworks; it is also used, to some extent, in chemical analysis.

Magnesium has a brilliant silver-white color, and is malleable and ductile. It preserves its brilliancy in dry air, but becomes tarnished by a film of oxide in moist air. The specific gravity of magnesium is 1.75, making its weight per cubic inch 0.0603 pound. It melts at a temperature of 1204 degrees F. Its boiling point is estimated at about 2050 degrees F. Its specific heat, at 32 degrees F., is 0.25, and its electrical conductivity (silver equals 100) is about 40.

Magnesium burns with a brilliant flame when heated in air or oxygen. This is the reason why, in machining magnesium and its alloys, precautions must be taken to prevent combustion and the starting of fires through the ignition of magnesium chips, a source of danger often encountered.

Some Applications of Hydraulic Operation to Machine Tools

A Number of Examples of Hydraulically Operated Equipment, Indicating the Wide Range of Possible Applications
Second of Three Articles

IN August MACHINERY, page 127, some examples of the application of hydraulic operation to machine tools were illustrated and described. In the present article, additional hydraulic equipment will be covered.

An Oilgear standard feed-pump unit equipped to provide two adjustable feeding speeds is shown in Fig. 4. This pump consists of a basic unit equipped with a small pilot valve and micrometer type hydraulic cylinder, as may be seen in Fig. 5. These parts are flanged integral with the pump. With this feeding unit, it is possible to obtain two preset feeds in the forward direction.

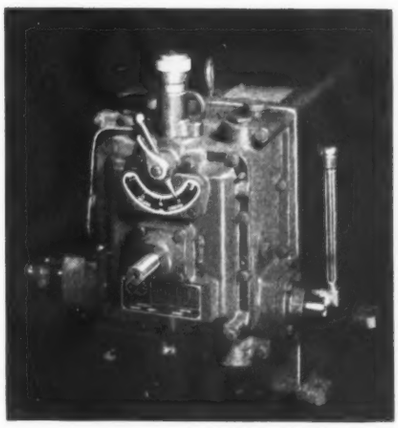


Fig. 4. Oilgear Feed-pump Unit Equipped to Provide Two Adjustable Feeding Speeds

On this type of unit, the coarse feed is preset by the small lever control on the face of the pump, and the fine feed is preset by the micrometer adjustment on top of the unit. When the control valve is in the feeding position, the high-pressure pump displacement will correspond with the setting of the lever control until the small pilot valve plunger is depressed, when the high-pressure volume of oil discharged will correspond with the setting of the micrometer adjustment. Operation of the small pilot valve which selects the fine feed can also be obtained by a cam or dog mechanism or by remote control through the use of the solenoid-operated mechanism in Fig. 6.

Variable-Volume Pumps

Variable-volume hydraulic pumps for operating presses, die-casting machines, chucks, clamps, and feeds for all kinds of machines are made with a continuous capacity rating of 1000 pounds per square inch by the Racine Tool & Machine Co., Racine, Wis. The vanes and rotor of these pumps are assembled in a pressure chamber ring, as shown in Fig. 7. The vanes *N* are fitted in the rotor slots, which slant away from the direction of rotation and are enclosed by hard bronze side plates, permitting close working and sliding fits without danger of scoring or seizing.

The inlet and exhaust ports *O* are designed to maintain a balanced pressure on the vanes as they slide in the rotor slots. With the pressure chamber in the position shown in the view to the left in Fig. 7, oil is admitted by the ports *O* shown on the left-hand side of the vertical center line. As the rotor and vanes revolve in the direction indicated by the arrow, the eccentric position of the pressure chamber ring causes the oil to be forced out through the exhaust ports *O* shown on the right-hand side of the vertical center line. The maximum volume of oil is delivered through

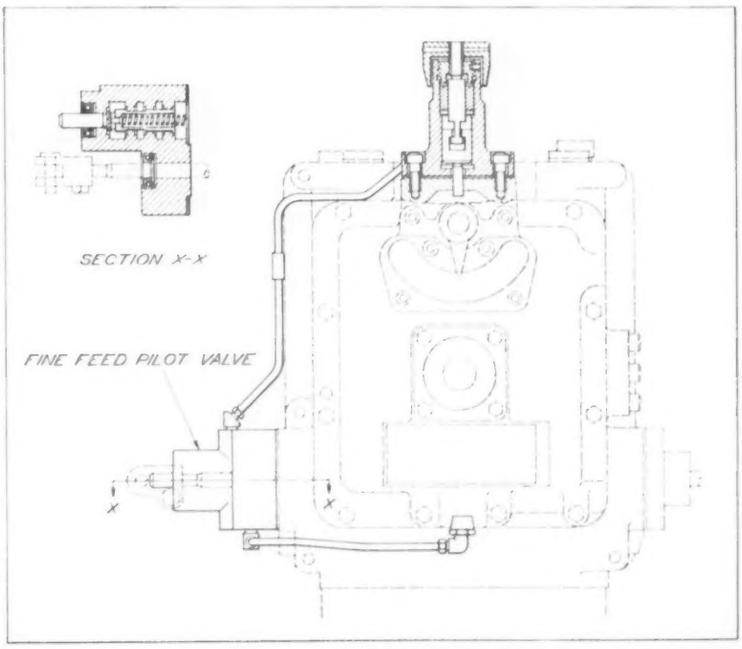


Fig. 5. Oilgear Feed-pump Unit with Fine-feed Attachment

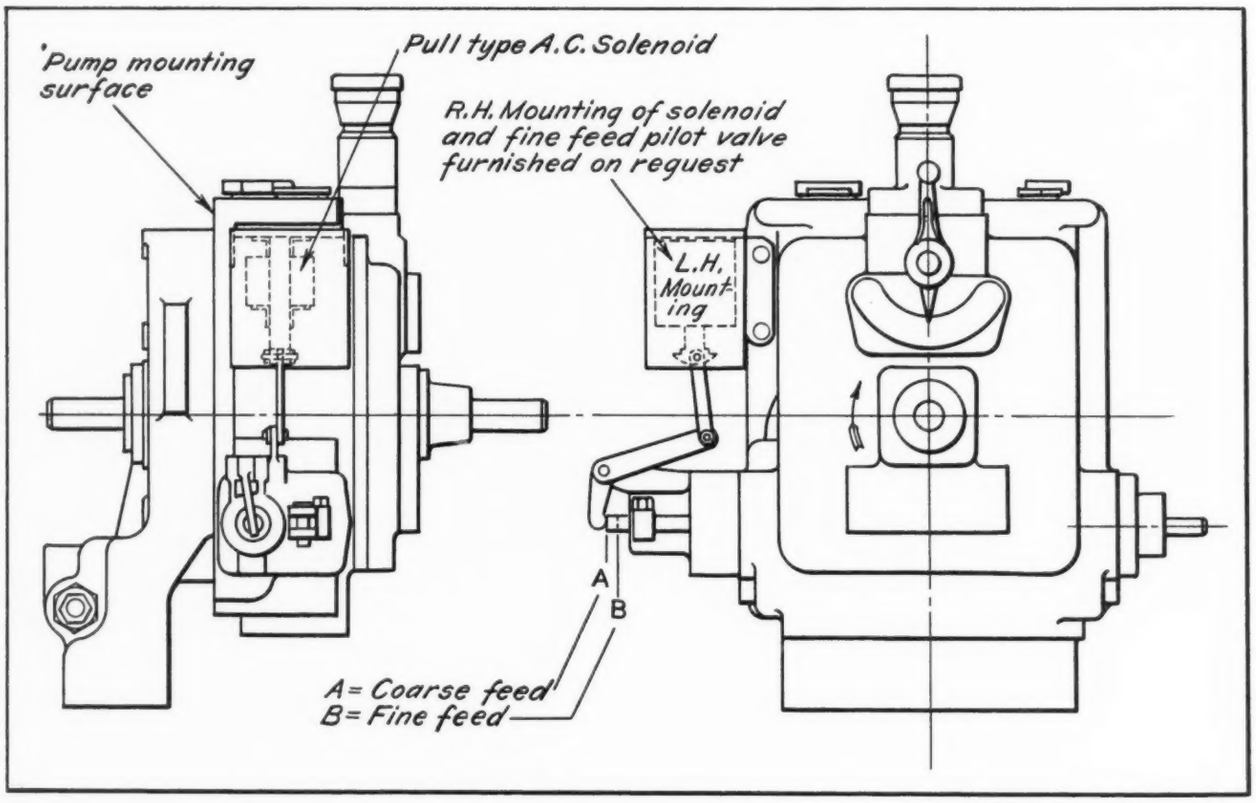
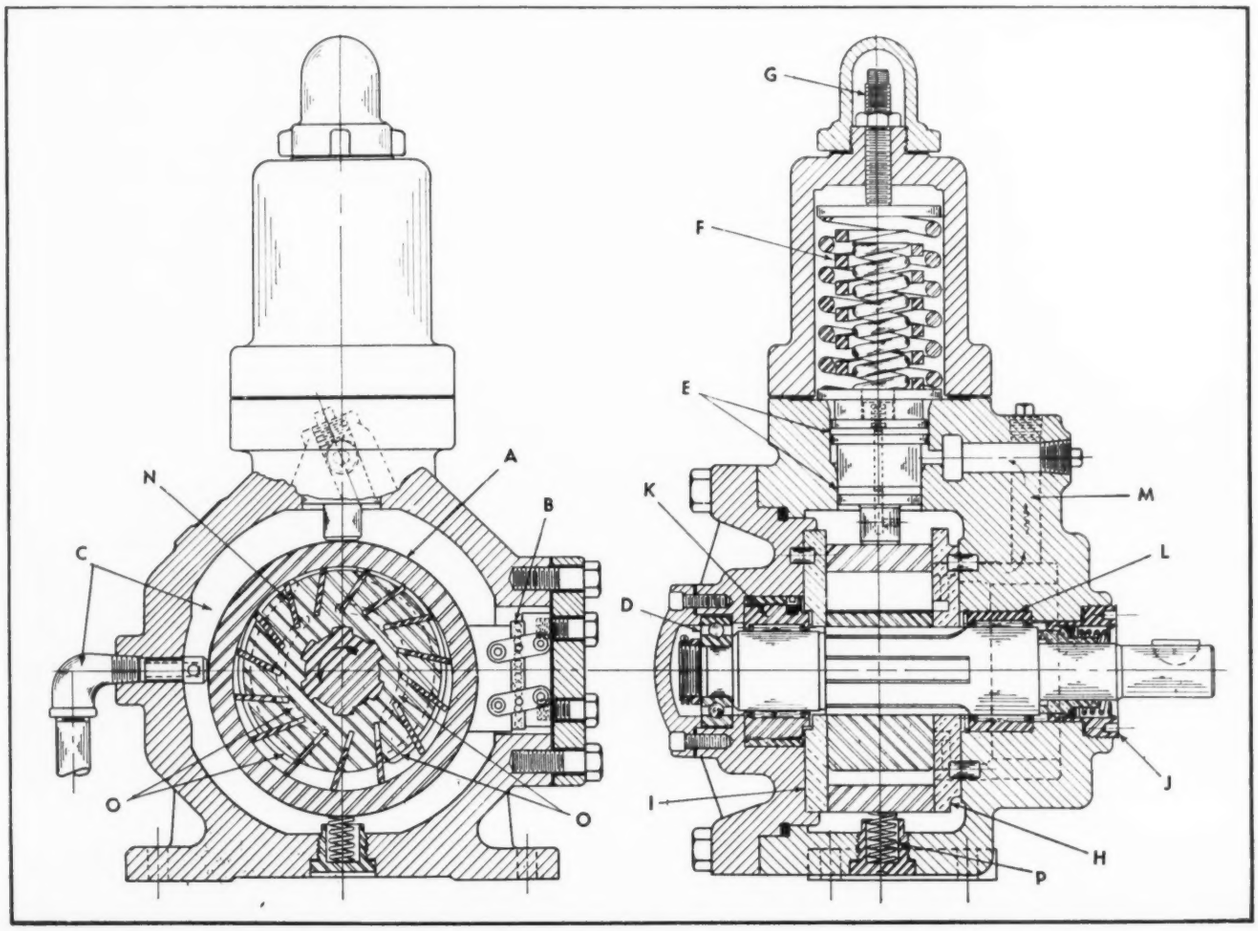


Fig. 6. (Above) Oilgear Fine-feed Unit with Solenoid-operated Mechanism

Fig. 7. (Below) Variable-volume Hydraulic Pump Made by Racine Tool & Machine Co., for Operating Die-casting Machines, Clamps, Chucks, and Feeds for All Types of Machines



the exhaust ports when the pressure chamber is in its lowest position, with the top of the rotor and the inside of the pressure chamber practically in contact.

The volume of oil delivered by the pump can be adjusted by a vertical movement of the pressure chamber, which is accomplished mechanically or automatically. When the pressure chamber is located in approximately a concentric position with respect to the rotor, there will be no in-and-out movement of the vanes and no oil will be forced out through the exhaust ports. It is obvious that any volume of oil, from zero up to the maximum capacity of the pump, can be delivered by merely changing the position of the pressure chamber.

Adjustment of the pump to deliver oil at full volume until a certain predetermined pressure is reached and then to deliver the volume required to maintain that pressure is obtained by means of screw *G*. Screw *G* adjusts the amount of pressure exerted on piston *E*, which normally forces the pressure chamber ring *A* downward against the pressure exerted by the supporting spring *P*, holding the chamber ring in position for pumping the maximum volume of oil before the rotor of the pump is started. When the pump is in operation, oil from the exhaust port passing through port *M* acts on the piston *E*, causing it to rise when the pressure of the exhaust oil reaches the point at which the adjusting screw *G* has been set. The piston, when raised in this manner, causes the pressure chamber to rise, increasing the clearance at the top of the rotor and thus reducing the amount of oil discharged through the exhaust port. A reduction in the oil pressure allows the piston to force the pressure chamber downward and thus increase the volume of oil discharged by the pump. This arrangement serves to control the volume of oil discharged as required to maintain the pressure for which the control springs *F* are adjusted by screw *G*.

* * *

General Pershing Speaks

In a foreword that General John J. Pershing wrote for a book entitled "You Can Defend America," he said: "America today is building ships—planes—guns. Are we building American character—spirit—the will to sacrifice? Are we building men who will pull together? Can we get total defense unless we are a united people? Does America need to be divided and quarreling to prove she is a democracy? . . . Nations in Europe went down because they were at war inside themselves. The people couldn't get together—refused to face facts—even when the storm broke men fought to get more for themselves. National unity is the heart of national defense. Our fight is against softness—indifference—laziness—extravagance—materialism—all of which are allies of the Fifth Column."

One-Thousandth Tank Completed by American Car & Foundry Co.

THE completion of the one-thousandth 12-ton combat tank by the American Car & Foundry Co., Berwick, Pa., was the occasion of a big celebration by the workers of the Berwick plant on August 2—a celebration that included a three-mile long parade, with the one-thousandth tank painted white and escorted by fifteen other tanks in grim battle garb. More than 5500 of the workers, with twenty-nine bands, were in the parade. Of special interest is the fact that it was the workers, themselves, who raised the money to pay for the celebration, and insisted on paying for all the bands, raising $2000 for martial music. A sham battle of tanks in which the fifteen tanks attacked and demolished a "fort," after disposing of "pill boxes" and "tank traps," formed part of the event.

Combat tanks are built from armor plate which makes up 30 per cent of their weight and forms the frame which serves as the chassis. About 75 per cent of the armor plate is heavy plate for the protection of the crew and the vital mechanism of the tank. The company's armor plate plant has been expanded nearly tenfold to meet its requirements, and is now able, in addition, to supply other manufacturers. Production is being stepped up to the point where one tank rolls off the 1100-foot assembly line every 45 minutes, with 43 tanks constantly in process between the start of the hull and the acceptance test.

What this means will be more readily appreciated when it is understood that in each tank there are 2865 different kinds of parts, with a total of 14,318 individual pieces, exclusive of the engines and accessory equipment. Machine work is performed on 705 individual parts, involving 2728 machining operations.

* * *

Westinghouse to Operate a $22,000,000 Government Plant Near Philadelphia

The Westinghouse Electric & Mfg. Co. will shortly build a $22,000,000 plant to manufacture steam turbines and gears for merchant ships for the United States Maritime Commission. The plant, adjoining the South Philadelphia works of the company, will be a self-contained unit constructed of steel, concrete, and brick, 1170 feet long by 490 feet wide. It represents a 25 per cent increase in the manufacturing space of the South Philadelphia works, and will employ over 1500 men. The manufacturing equipment will include sixteen large gear-hobbing machines housed in an air-conditioned room.

The steam turbines to be delivered annually by the new plant will have a total capacity of 630,000 H.P.—sufficient to drive one hundred 10,000-ton ships.

Bullard Company Adds Large Assembly Plant

The New Machine Tool Assembly Plant Just Completed by the Bullard Co., Bridgeport, Conn., in Record Time. Construction was Started on April 28 and the Building was Completed on July 4. The Equipment was Installed in Ten Days

A BUILDING to be used for assembling and erecting the machine tools built by the company has been constructed in record time by the Bullard Co., Bridgeport, Conn. This $4,000,000 addition, built on land adjoining the present plant, measures 540 by 180 feet, rising to a height of 60 feet above the main floor, under which is a basement that extends half the length of the building. The new structure contains more than 3 acres of production space.

The steel for the building was delivered on the site on April 28, this year; the company took possession of the plant on July 4; operating and manufacturing equipment was installed during the ten-day period ending July 14; and within twenty-four hours thereafter, finished machine tools were being shipped to meet urgent orders in the aircraft, automotive, and other defense industries.

With this building in operation, it is estimated that the Bullard production of machine tools in 1941 will be double that of 1940. The number of employes has also doubled, increasing from 1600 last year to more than 3200 at the present time. The Bullard apprenticeship system, operated in conjunction with the State Trade School in Bridgeport, has played a major part in training the new employes required for this expansion.

Monday, July 28, a number of representatives of the United States Army and Navy, the Office of Production Management, directors and members of the Defense Committee of the National Machine Tool Builders' Association, members of the Connecticut State Educational Department, and others were given an opportunity to inspect this new building as guests of the Bullard Co. It was the unanimous opinion that this structure is one of the most outstanding of the many fine plants recently erected.

President Roosevelt on Prices and Wage Rates

President Roosevelt, as quoted in the *Labor Relations Bulletin*, recently said: "There cannot be price stability if labor costs rise abnormally—labor has far more to gain from price stability than from abnormal wage increases, for these are likely to be illusory and quickly overtaken by sharp rises in living cost. . . . Labor as a whole fares best from a labor policy which recognizes that wages in the defense industries should not substantially exceed the prevailing wage rates in comparable non-defense industries where fair labor practices have been maintained."

Now what the country is interested in is this: What is the President going to do to prevent price increases due to unduly high wage rates? Is the President going to do anything about conspiracies to stop work on defense production for the purpose of forcing wage increases at a time when the country is threatened as it has never been before?

Standard Carbide Tools Used as Inserted Blades for Multiple-Blade Cutters

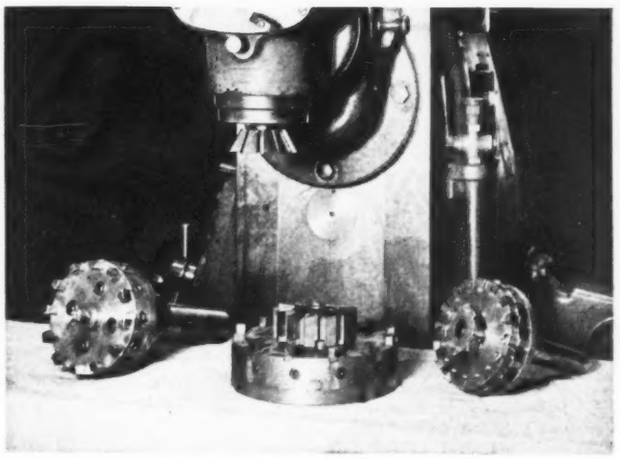


Fig. 1. Multiple-blade Milling Cutters in which Standard Carbide Tools are Used for Inserted Blades

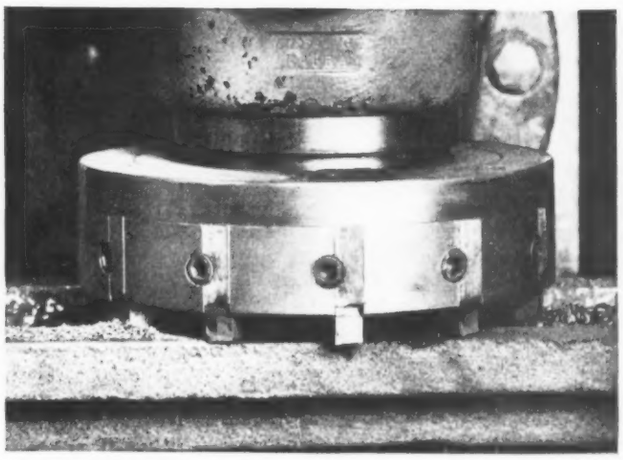


Fig. 2. Close-up View of Milling Cutter Shown at the Left in Fig. 1, Engaged in Milling Operation

A NOVEL method for making tungsten-carbide, multiple, inserted-blade cutters has recently been adopted by a number of manufacturers, including the C. A. Porter Machinery Co., Grand Rapids, Mich. The idea, basically, consists of using the new standard tungsten-carbide turning, facing, and boring tools as inserted blades for the multi-bladed cutters. Use of such standard tools manufactured on a mass-production basis avoids delays incident to the design and production of special tools or blades, particularly under present conditions. At most, it is necessary only to cut off the shanks of such tools and, perhaps, regrind the edge to the desired cutting angle.

At the plant of the Porter company, the assembled tools are used largely for face-milling cast-iron machine parts, production being comparable to that encountered in job shops. The cutter bodies are made at this company's plant and are finally assembled in its tool-room after grinding the standard tools employed. For this grinding work, a cutter-grinder equipped with silicon-carbide and diamond wheels is used.

Three of the assembled multi-bladed cutters are shown in Fig. 1. The cutter at the left is used for face-milling the ways of several types of machines. The face-milling blades are produced from 1/2-inch square Style T-4 Carboloy tools. A close-up view of the operation in which this cutter is used is shown in Fig. 2. In the center view, Fig. 1, is shown a combination milling cutter with a special carbide-tipped cutter in the middle. The face-milling blades are similar to those in the cutter at the left.

The combination milling cutter at the right, Fig. 1, has the face-milling blades made of Style T-4, 1/2-inch square, standard tools converted simply by cutting off part of the shank length, while the cutter in the center is carbide-tipped by brazing on special tips.

Importance of Using Machine Tools Already Available

IN a statement recently made by Charles J. Stilwell, president of the Warner & Swasey Co., Cleveland, Ohio, the necessity of making adequate use of machine tools available in plants throughout the country was emphasized. Mr. Stilwell said that, from surveys made by his company and through information obtained from other sources, it appears that the idle time of machine tools already available represents a national defense production capacity larger than that of a whole year's output of new machine tools. To put existing machine tools to work is an important matter.

Says Mr. Stilwell, "Remember there is no substitute for time. Panzer divisions conquer a country in a matter of weeks. Shall we let machine tools already installed in manufacturing plants remain only partly used while the defense program waits for machine tools, many of which have not yet even been ordered—machine tools that, in spite of the utmost exertions of the industry cannot be delivered until well into 1942? Putting in operation a machine tool now idle is the equivalent of a new machine tool today." This applies to machine shops, as well as to machines.

Electromagnetic Feeler-Gage Control

Application of Electromagnetic Control to an Automatic Die-Sinking Machine—Last of a Series of Four Articles

APPLICATIONS of an automatic measuring gage-controlled feeler to regular die-sinking and contour-milling operations were described in August MACHINERY, page 135. The present article covers the manner in which this device is used to control an automatic die-sinking machine. As shown in Fig. 12, the machine comprises the horizontal table *H* carrying the master and workpiece, and the vertical slide *V* on which is mounted the axial slide *T* with the feeler and the cutter-spindle, together with a direct-current, variable-speed motor.

The base of the machine accommodates two converter sets assembled in one casing. The direct-current variable-speed motor M_H drives the table. The motor M_V, flanged to the standard, actuates the vertical movement of the slide *V*, and the motor M_T drives the horizontal lead-screw *L*, which moves the axial slide *T*, through the vertical spindle *S* and helical gearing at *W*. The tracing of the contour can be accomplished either horizontally or vertically, beginning from the left or right or top or bottom of the model. The amount of the vertical or horizontal feed—that is, the distance between the successive traverses at the end of each stroke—can be varied as required. After the whole surface has been traced, the machine stops automatically.

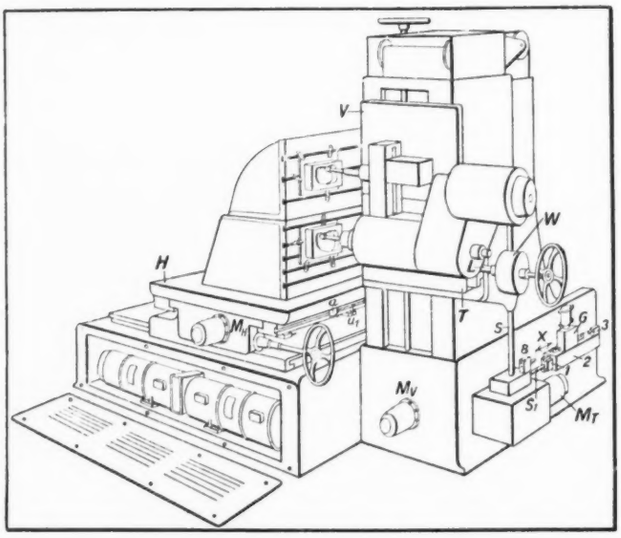


Fig. 12. Automatic Die-sinking Machine with Built-in Electromagnetic Feeler-gage Control

Automatic reversal of the main feed and changing over for the next feed line at the end of each stroke are accomplished by means of two adjustable dogs actuating corresponding end switches; four auxiliary relays for the preselection of the direction and sequence of the main feed lines; an electric time relay for adjusting the distance between the successive strokes; and an additional auxiliary relay for engaging and disengaging the vertical or horizontal feed adjustment. Two additional relays and a lifting magnet provide for automatic die-sinking by several successive cuts and for stopping the machine at the completion of the operation.

Setting-up movements of the feeler pin and cutter and the taking of trial cuts by hand are effected by a joy-stick type of control lever which can be moved either to the right or left or up or down. Thus, if the lever is set in the right-hand position, the motor M_H is started through its switch, causing table *H* to travel to the right, while if the lever is set in the left-hand position, the table is fed to the left. Vertical movements of the slide *V* are controlled in a similar manner from the "up" and "down" positions of the control.

In advancing, the feeler moves toward the master until it makes contact with it, when the armature of the axial gage-head is deflected and the axial motor M_T is stopped. Should contact result in greater pressure, the armature would be deflected so much that the axial motor would be reversed and withdrawal of the feeler would take place. If the movement of the feeler should cause it to be deflected excessively, the movement of the feeler and cutter would instantly be stopped. A similar stop action is provided for the horizontal and vertical measuring heads. Another selector switch permits setting the machine for horizontal or vertical feed for contour milling.

With the set-up operation completed, the joy-stick control lever is disconnected by another switch from the motor switches and connected to a set of auxiliary relays which are operated automatically. The machine is then started by moving the joy-stick control lever to the desired position, causing the proper auxiliary relay to be energized and the work cycle to begin. Thus, if the cutting feed is to be in the horizontal direction, the joy-stick control is moved to "horizontal," the "horizontal" relay is actuated, and horizontal feed motion begins. Immediately thereafter, the control lever is shifted back to neutral position, where it remains throughout the automatic cycle.

When the feeler reaches the extreme right-hand end of the stroke, the horizontal "right" motor is

cut out by the dog a coming in contact with limit switch U_1, and the vertical "down" motor is operated for a short predetermined period. Then this motor, in turn, is stopped, and the horizontal "left" motor brings the feed back in reverse.

As soon as the feeler has traversed the whole surface of the model and reached the end of the lowest horizontal line, a vertical dog cuts out the horizontal motor, and the machine stops, if set for normal vertical-feed adjustment. If set for milling with successive cuts, the vertical "up" motor is cut in, and the feeler and cutter return to their initial position to resume the work cycle.

Die-sinking can, of course, be carried on with the main feed motion in a vertical direction. The length of stroke, in this case also, is controlled by adjustable dogs, while the horizontal feed adjustment for successive cuts can be varied between 0.020 and 0.800 inch by the electric time relay.

Automatic Machining of Deep Forms and Cavities of Widely Varying Depths

Masters having comparatively high projections or deep cavities are traced with several successive traverses by means of an automatic in-feed depth control. This operates in such a way that the cutter is fed into the work only by the amount that corresponds to the adjusted depth of cut, the in-feed of the feeler being arrested by an end switch controlled by an adjustable stop, even though the feeler has not made contact with the master. For the next traverse, the stop is automatically readjusted by an amount corresponding to the depth of cut, and this continues until, finally, the stop strikes a second end switch, which disconnects the entire drive.

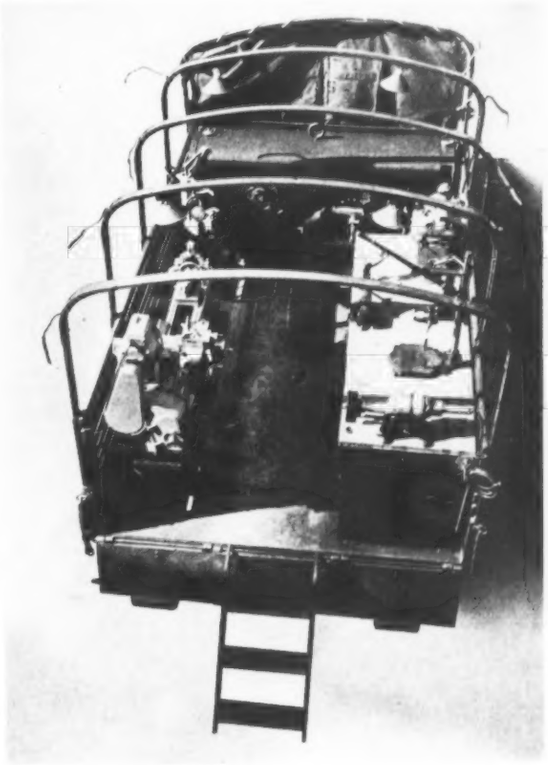
The depth control consists of a small slide *2*, moving on the slideway *1* and driven in synchronism with the vertical spindle S through the horizontal spindle S_1 by the motor M_T. The slide *2* carries the end switch *3* that controls the depth of each cut and the box G containing a magnetically operated stepping relay which, through a ratchet and pawl mechanism, automatically displaces a rack through a predetermined distance. The rear end of the rack operates in conjunction with the end switch *3*, which interrupts the in-feed motor. On the front end of the rack is an adjustable stop which operates in conjunction with the fixed end switch *8*. The latter is mounted on the standard of the machine, and by the aid of a micrometer screw, can be set for the total depth of cut X.

With this type of controlled operation, it is possible to rough out dies or molds to a few hundredths inch over size, and then take a final cut with the finishing cutter after the micrometer screw has been set to the final size. The amount of in-feed can be preset from 1/16 to 5/8 inch, the rack being automatically adjusted after each cut.

In using this automatic depth control, the machine is set for milling by successive cuts, and so operates automatically until the adjusted total depth of cut has been reached. The cutter is carried by a series of horizontal cuts entirely over the surface to be milled, after which it is returned to its initial position and fed in toward the work for another succession of horizontal cuts at a deeper level.

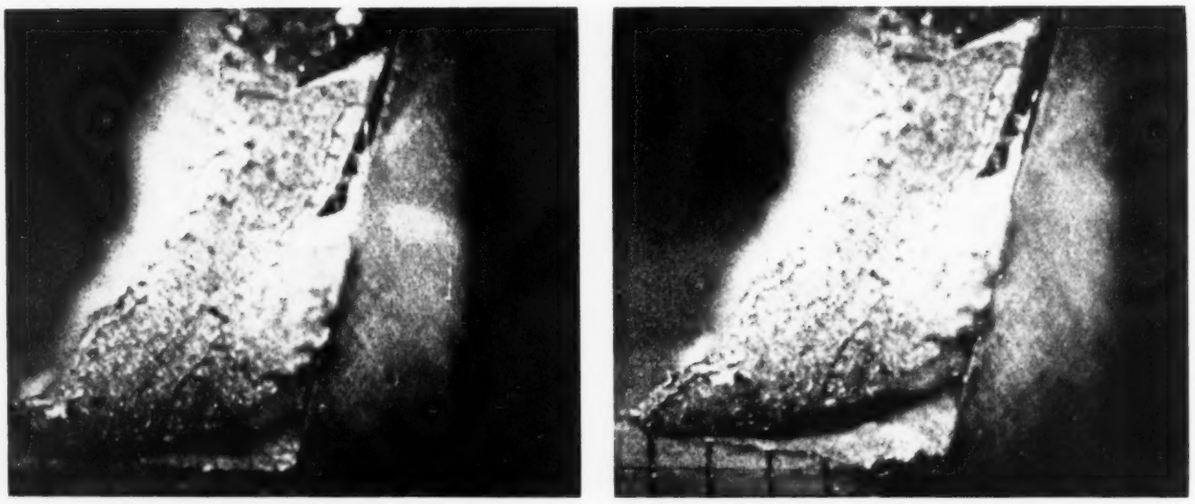
In the case of large dies having cavities of widely varying depths, it is common practice first to traverse the entire surface of the master, with the length of strokes controlled by adjustable stops. For tracing very deep portions of the cavity, the ball type of control lever can be used to determine the amount of cut and the length of stroke, thus resulting in a considerable reduction in idle time. The operation can be further accelerated by providing extra stops on the table and vertical slide for controlling the lengths of stroke.

By setting the selector switch for contour milling, the end and change-over switches, as well as the automatic depth-control system for die-sinking operations, are rendered inoperative. With the operating switch in the setting-up position, the feeler and cutter can be moved up or down and to left or right by actuating the control lever, irrespective of the position of the control drum. The control lever remains inoperative when the operating switch is set to the working position.



The Army's Latest Machine Shop on Wheels—a Machine Shop Mounted on a Special Army Truck Containing a Lathe, a Brake Reliner, a Power Generator and an Arc Welder, a Valve Refacer, a Vise, a Drill Stand, and a Grinder (Photo Courtesy Hobart Brothers Co.)

High-Speed Photography Applied to the Study of Cutting Metal

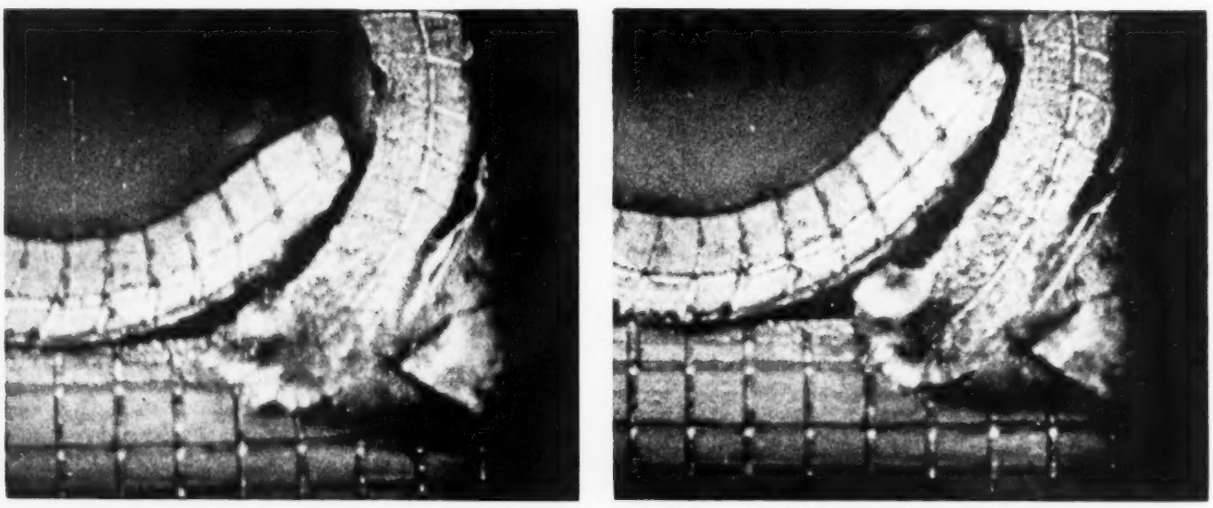


Two Illustrations Showing the Formation of a Chip when Using a Tool with a 16-degree Rake Angle. The Material being Cut is Mild Steel

A STUDY by means of high-speed photography to determine what takes place when metal is cut on machine tools has been undertaken by the General Electric Co.'s engineering department and works laboratory. By the use of a high-speed camera, it has been possible to record what takes place at the cutting edge of a tool operating at normal cutting speeds. The high-speed camera caught all essential details. The pictures were then magnified, the action slowed down to one-sixtieth of normal speed, and a detail study of the results made.

The object of the studies was to determine the correct cutting angles for cutting various materials and to study the irregularities in the cutting action of the tools due to any mechanical defects in the machine tool itself. The chip formation, as influenced by various rake and clearance angles on the cutting tools, was studied. Lathe and planer tools and milling cutters were used in the tests. A study was also made of the effects of various coolants on the chip flow.

The first experiments were made by using a planer and a milling machine for cutting steel, cast iron, and brass. The work was in the shape of an angle iron, making it possible to control the chip and allowing the camera to be focussed on the point that would give the best view of the chip.



Two Illustrations Showing the Formation of a Chip when Using a Tool with a 24-degree Rake Angle. The Material being Cut is Mild Steel

The front of the work being cut was inscribed with both vertical and horizontal lines 1/32 inch apart. In this way, the distortion of the metal could be studied in both the chip and the work while the cut was being taken.

It was discovered that when a cut is taken on a milling machine, each cutter tooth puts an increasing strain on the arbor as it progresses. This actually causes the arbor to become slightly distorted or to "wind up." As the tooth emerges from the cut, this energy in the arbor is released, causing the cutter to spring forward. This action was clearly caught by the camera.

By the use of the high-speed camera, it has been found possible in other fields to note the action of mechanisms, the motion of which is too fast for the naked eye to observe.

* * *

Meetings of the Industrial Supplies Industry

Approximately forty meetings are planned to be held in industrial centers, as fast as they can be scheduled and arranged, under the auspices of the Industrial Supplies Defense Committee of the Industrial Supplies Industry, of which W. C. Stauble, vice-president of the Holo-Krome Screw Corporation, Hartford, Conn., is chairman. Meetings have already been held in Waterbury, Conn., Cleveland, Ohio, and Los Angeles, Calif. These meetings were attended by a very large number of manufacturers of equipment, tools, and supplies; industrial supply distributors; and users of industrial products. At the Los Angeles meeting, E. C. Ducommun, of the Ducommun Metals & Supply Co., was chairman, and Joseph L. Overlock and H. K. Clark, of the Office of Production Management, were present to explain the procedure and answer questions relating to the Defense Supplies Rating Plan.

The next meeting is scheduled to be held at the St. Francis Hotel, San Francisco, Calif., September 3. A. J. Glesener of the A. J. Glesener Co., will act as chairman of this meeting, at which Mr. Overlock and Mr. Clark will also be present. Further meetings are scheduled for Denver, Colo., September 5, and Chicago, Ill., September 9. Information relating to other meetings, as fast as they are scheduled, can be obtained from R. H. Young, Holo-Krome Screw Corporation, Hartford, Conn.

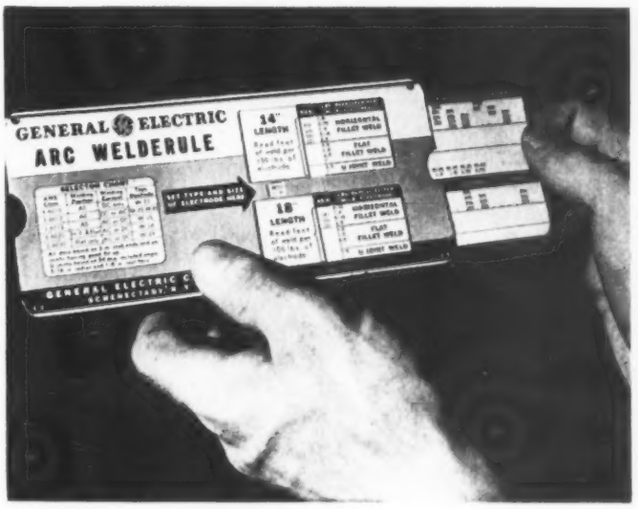
* * *

Since the outbreak of the war, the allocation of nickel in Canada and the United Kingdom has been handled in accordance with the wishes of the Canadian and British governments. Last March, all nickel imported or produced in the United States was placed on a priority basis, and its allocation directed by the Division of Priorities of the Office of Production Management.

"Arc Welderule" for Estimating Electrode Requirements

By H. O. WESTENDARP, JR., Welding Engineer
General Electric Co., Schenectady, N. Y.

Engineers, purchasing agents, operators, and others who use or supervise the use of arc-welding electrodes will be interested in the new General Electric "Arc Welderule" shown in the accompanying illustration. This device, developed to save time in estimating electrode requirements, operates similarly to a slide-rule. The length of arc-welded joints obtainable for each 100 pounds of electrode and the number of pounds of weld metal



Estimating Electrode Requirements with the "Arc Welderule"

deposited for each 100 pounds of electrode can be read directly from the device. The information covers eleven commonly used sizes and types of joints; also twenty-two sizes and types of electrodes in both the 14- and 18-inch lengths.

Although general data of a similar nature has been published in bulletin form, the new Arc Welderule, of convenient vest-pocket size, enables more accurate estimates to be made, as it applies to specific types and sizes of electrodes. An additional feature of the Arc Welderule is a "selector chart," which shows the various filler metal classifications as specified by the American Welding Society and the types of electrodes that meet these classifications.

* * *

During the first seven months of this year, the strikes in the defense industries caused a loss of approximately 4,360,000 man-days. This is equivalent to a loss of $30,000,000 worth of defense equipment; this estimate is based on defense work computations of the Bureau of Labor Statistics.

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Metal Surfaces Sensitized for Photographic Purposes

Following up the development of photographically sensitized aluminum sheets, Republic Engineering Products, Inc., 480 Lexington Ave., New York City, have completed a new process whereby other materials, such as steel plate, brass, copper, various steel alloys, as well as plywood and plastics, can be coated with a sensitized emulsion suitable for making photographic copies. One application of this process is the making of templets by the photographing of drawings directly on the sensitized surface. This method of producing templets is described in the leading article of this number, page 107. A considerable amount of hand lay-out time is thus saved. Nameplates, instrument dials, and permanent instruction sheets are also readily produced by this method. These various materials in sensitized form are now being supplied by this company. 201

Rubber-Base Coating Protects Metal from Moisture and Corrosion

"Paratex," a rubber-base coating developed by Truscon Laboratories, Inc., Caniff and G.T.R.R., Detroit, Mich., is a fast drying, waterproof covering material made from chlorinated rubber. It is highly resistant to water and many corrosive agents that attack metals. When used in conjunction with Paratex metal primer, which contains inhibitive pigments, it is especially suitable for protecting steel work exposed to salt air.

The rubber-base coating itself is unusually resistant to ordinary solvents such as gasoline, kerosene, and lubricating oil, and also is resistant to alkalies, soda ash, and inorganic salts in dust or powder form and solutions of these under 168 degrees F., when contact is one of intermittent splashing or flushing, as well as to dilute acid fumes at temperatures under 168 degrees F.

In addition to water-tight film and rust-inhibitive qualities, the Paratex metal primer used in conjunction with Paratex metal coating has an unusual action designated as "lateral absorption." Thus, when this primer is applied over scales of rust and paint that do not have true adhesion to the metal surface, the primer penetrates beneath the scales and turns up the edges to view. In this way, defects are revealed during the priming operation, at a time when they can be economically corrected. 202

Electrolytic Process for Blackening Almost All Metals

A process for the electrolytic blackening of almost all metals, including aluminum, steel, stainless steel, zinc, cadmium, nickel, silver, gold, lead, tin, and various alloys, has recently been announced by the Enthone Co., 440 Elm St., New Haven, Conn., under the name "Electro-Ebonol." The development of this process is of importance in view of the shortage of nickel salts. The deposits obtained are said to be harder, blacker, and more adherent than those produced with the customary black nickel solutions.

A solution of 12 ounces of Electro-Ebonol salts per gallon of water is used at a temperature of from 140 to 190 degrees F. The work is cleaned for blackening in a manner similar to the cleaning preceding plating. The black coating is deposited in from thirty seconds to three minutes, depending upon the current density, which may range from one-half to five amperes per square foot at one to two volts. The anodes are of carbon or stainless steel, and wood, stainless steel, ceramic or Monel metal tanks may be used. The throwing power of the solution is claimed to be unusually high... 203

Nickel-Steel Spring Becomes Stiffer with Increase in Temperature

A new spring, now available commercially, utilizes the property of a 36 per cent nickel steel to become stiffer as its temperature increases. Such springs are combined with under-correcting springs—that is, springs having an opposite tendency—or with other elastic elements such as bellows, diaphragms, etc., to produce instruments, the

To obtain additional information about materials described on this page, see lower part of page 156.

accuracy of which is virtually unaffected by temperature changes.

While the ordinary steel or alloy spring becomes approximately 2 per cent more resilient for every increase of 100 degrees F. in temperature, it is claimed that these new self-compensating springs can be held constant within 0.02 per cent for such a temperature increase.

These springs, made by All-Weather Springs, 72 Washington St., New York City, are now being used in spring scales, aeronautical instruments, and other spring-actuated devices that are subjected to wide variations in temperature during operation. 204

Synthetic Material that can be Substituted for Zinc Coating

A corrosion-resistant synthetic coating known as Roxaprene gave highly satisfactory results when subjected to comparative tests by the manufacturer, the Roxalin Flexible Lacquer Co., Elizabeth, N. J. When immersed in a 2 per cent caustic solution, unpainted, hot-dip galvanized steel showed corrosion in as short a time as 50 hours, whereas Roxaprene-coated steel was unaffected at the end of 600 hours. Another test utilizing a dilute hydrochloric acid solution indicated that the Roxaprene coating would stand up for 96 hours when immersed, as against failure in 2 1/2 hours for galvanized coatings. Roxaprene can be applied by dipping, spraying, or roller coating. It dries quickly in the air, and can be force-dried in about half the time usually required by conventional synthetics. This finish has already been successfully used on air-conditioning equipment, motor trucks, fans, blowers, pumps, and special machinery...205

Alkaline Copper-Plating Process Helps to Save Nickel

The Unichrome alkaline copper-plating process recently developed by United Chromium, Inc., 51 E. 42nd St., New York City, provides a fine-grained, smooth, copper base for bright nickel-plating, and, where buffing is required, results in an easy flow, minimum wheel wear, and low labor costs. The use of this process makes possible a satisfactory plating operation in which the amount of nickel is substantially reduced from that heretofore used, an important feature in view of the present shortage. In place of the nickel, additional copper is used.

The customary cleaning cycle is used before plating; and with steel or die-castings, a copper strike is recommended. The Unichrome copper-plating bath is non-corrosive to flesh, clothing, and equipment. No salt crusts are formed on the tank, work rods, or anodes. 206

New Enamel Provides Faster Drying Machine Tool Finish

A new and faster drying synthetic enamel for machine tool castings, which also provides greatly increased resistance to cutting compounds, has been placed on the market by the Sherwin-Williams Co., Cleveland, Ohio. This finish is known as "Kem Machine Tool Enamel." Four coats can be applied in 5 3/4 to 8 1/2 hours, as compared with a day and a half to four days for the oil enamel method.

A typical drying schedule would be: First, spray or brush coat of zinc chromate primer—drying time fifteen to thirty minutes; second, application of machine filler—drying time four to five hours; third, application of "Kem Sealer Gray"—drying time fifteen to thirty minutes; fourth, application of "Kem Machine Tool Gray"—drying time fifteen to thirty minutes. 207

As a Safeguard against the Hazard of Fire or Explosion Caused by Static Electricity, Industrial Vehicles Operating in Plants Manufacturing Explosives, Gunpowder, or Other Inflammable Materials may now be Equipped with Tires made of a Special Rubber Compound that Conducts Electricity. In the Accompanying Illustration, a Current is being Passed through the Tire Sufficient to Light a Neon Bulb in Contact with the Surface of the Tire. This is a Recent Development of the B. F. Goodrich Co., Akron, Ohio

To obtain additional information about materials described on this page, see lower part of page 156.

New Engineering Encyclopedia Covers 4500 Subjects

ENGINEERING ENCYCLOPEDIA. Two volumes, 6 by 9 inches. 1431 pages; 206 illustrations. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $8.

The ENGINEERING ENCYCLOPEDIA supplies, in condensed form, the essential facts about 4500 standard and special engineering subjects. Although intended primarily for reference purposes, the Encyclopedia is designed to give students, whether young or old, a broad fund of knowledge relating to the outstanding subjects in many different branches of engineering. Because of the scope and miscellaneous character of this two-volume work, it is, of course, impossible to describe adequately the contents. In general, this Encyclopedia consists of concise treatises ranging from short paragraphs to several pages in length. These deal with various important mechanical laws, rules, and principles; physical properties and compositions of a large variety of materials used in engineering practice; the characteristic features and functions of different types of machine tools and other classes of manufacturing equipment; and so many other subjects that a mere list would occupy thirty-six pages in MACHINERY if set double column in type of this size and allowing one line per subject. These condensed treatises are accompanied by definitions of numerous trade and technical terms used in engineering and manufacturing practice.

Specific reference to a few subjects, by way of illustration, may be misleading because of the apparent emphasis on the few selected, but, nevertheless, as a very general indication of the character and variety of this work, suppose you want to know which of the four American Standard screw thread fits is recommended for most interchangeable screw threads; or why some tool steels are designated as "finishing" steel; or about flame-hardening and flame-softening; or how to lay out hobs for hobbing spline shafts; or the American Standard sizes for mechanical drawings; or why the use of "preferred numbers" is advocated; or the meaning of commercial wire classifications, such as bright wire, merchant wire, market wire; or the distinguishing features of an Aero-thread; or the meaning of the octane number of gasoline; etc., etc.

All matter is arranged alphabetically under the heading or word likely to be referred to, thus making the Encyclopedia self-indexing. Whenever a subject might properly be placed under more than one heading, such additional headings are included with suitable cross references. There are also many cross references to whatever subjects may be closely allied to any given subject. While it obviously is impossible to cover every conceivable subject, this work of reference is unusual in its scope.

Second Edition of Machine Shop Training Course

MACHINE SHOP TRAINING COURSE—Second Edition. By Franklin D. Jones. Two volumes, 6 by 9 inches. Volume 1, 538 pages, 334 illustrations; Volume 2, 552 pages, 209 illustrations. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, complete two-volume course, $6; Volume 1 or 2, if purchased separately, $4.

This second edition of MACHINE SHOP TRAINING COURSE is practically the same as the first edition with the exception of some additional matter of considerable importance to many students of machine shop practice. This two-volume treatise—which is especially designed for shop courses, technical trade schools, and also for self-instruction—now has, as one extra feature, an original series of blueprint reading charts. This series of twenty-nine full-page charts, all in color, shows by a simple progressive method just how to read or understand mechanical drawings. Each chart consists of from two to five drawings especially selected to illustrate, step by step, the fundamental principles underlying blueprint reading. The essential points in each case are explained by text directly opposite each drawing, and the drawings and charts are systematically arranged so that the student or apprentice can readily acquire a broad understanding of the principles governing the proper interpretation of mechanical drawings.

These blueprint reading charts are supplemented by a series explaining the meanings of various standard abbreviations or symbols. Typical applications of these abbreviations or symbols are illustrated in all cases by means of detail drawings. American Standard screw thread symbols, as well as standard cross-section lines for different materials, are included in this series.

Another extra feature of the second edition is a chapter on "Engineering Standards Applied in Machine Building." This chapter features particularly those standards that are of especial importance in the machine shop; in other words, standards relating to parts or elements which are utilized so generally that the adoption of standard forms or sizes is essential. The purpose of this chapter is to give the main facts only, or information that will be useful not only in shop work but also in the reading of blueprints or mechanical drawings.

* * *

When we say "United we stand, divided we fall," we must think not in terms of individuals or states, but in terms of the nations who believe in and live for the same things, and it is only through a continuation of this policy that the peace will be worth fighting for.—*Chester B. Morrison, York Ice Machinery Corporation*

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Fill in on Form at Bottom of Page 155 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the September Number of MACHINERY

Cone-Drive Gearing

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit, Mich. Two new booklets on cone-drive gearing, one (Bulletin CW-41B) for executives, entitled "Why Cone-Drive," and the other (Catalogue CW-41A) for engineers and designers. The latter gives complete specifications of standard blanks for worms and wheels, tables of ratios for which tooling is available, charts and formulas for computing sizes, stresses, loads, etc., of cone drives. 1

Wear-Resisting Metal

METAL CARBIDES CORPORATION, Youngstown, Ohio. Catalogue 41, on Talide metal for wear resistance, suitable for such purposes as work-rest blades for centerless grinders; lathe and grinder centers; drill jig bushings; burnishing tools; plug and ring gages; diamond impregnated tools; sheet-metal drawing dies; wire, tube, and extrusion dies, etc. 2

Dustproofing Devices for Internal-Combustion Engines

DONALDSON CO., INC., 666 Pelham Blvd., St. Paul, Minn. Twenty-fifth anniversary publication covering the history of the concern and showing the various types of oil-washed air cleaners built by the company for protecting internal-combustion engines and other industrial power machinery from dust. 3

Impact Testing Machine

TINIUS OLSEN TESTING MACHINE CO., 500 N. Twelfth St., Philadelphia, Pa. Bulletin 22, illustrating and describing the Olsen impact testing machine equipped with a "Change-O-Matic" head which adapts it for making Charpy, Izod, and tension impact tests without removing or adding any tools or parts. 4

Metal-Spraying

METALLIZING ENGINEERING CO., INC., Long Island City, N. Y. Booklet entitled "How to Get Along With Less Priority Metal," showing how the metal-spraying process can be used in production and maintenance work to effect unusual savings, not only in metals, but in costs. 5

Milling Machine Research

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. Booklet entitled "Chip Formation, Friction and Finish," giving the latest research information available on what happens when metal is removed by a cutting tool, especially in a milling machine. 6

Molding Plastics

BAKELITE CORPORATION, UNIT OF UNION CARBIDE AND CARBON CORPORATION, 30 E. 42nd St., New York City. Catalogue containing general information on the plastic molding process, and showing examples of the variety of products made from Bakelite plastics. 7

Portable Power Assembly Tools

BLACK & DECKER MFG. CO., Towson, Md. 56-page data book on power assembly tools—portable electric screwdrivers, nut runners, and tappers—containing, in addition, much information on bolt, nut, cap-screw, and lag-screw sizes; socket wrenches; tap drill sizes; etc. 8

Vibration Control

KORFUND CO., INC., 48 Thirty-Second Place, Long Island City, N. Y. 4-page bulletin describing the application of steel spring resilient mounting to drop-hammers in aircraft plants to prevent the transmission of vibration to other machines. 9

Machinists' Small Tools

BROWN & SHARPE MFG. CO., Providence, R. I. Catalogue 34 (512 pages), listing the company's complete line of machinists' precision tools, milling cutters, hobs, arbors, adapters, collets, screw machine tools, pumps, and other auxiliary equipment. 10

Spring Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Booklet entitled "New Spring Alloys for Tough Jobs," giving performance and technical data on "Z" nickel, "K" Monel, Monel, Inconel, and malleable nickel as used for spring purposes. 11

Comparator Gages

MOORE PRODUCTS CO., 3629 N. Lawrence St., Philadelphia, Pa. Leaflet describing Moore pneumatic comparator gages, which provide a large amplification of minute dimensional differences, applicable for both internal and external measurements. 12

Feed-Fingers and Pads for Automatic Screw Machines

HARDINGE BROTHERS, INC., Elmira, N. Y. Circular listing the advantages of Morrison Style B master feed-fingers and pads for automatic screw machines, together with prices and information for ordering this equipment. 13

Pickling and Neutralizing Materials

OAKITE PRODUCTS, INC., 26 Thames St., New York City. Booklet describing how some recently developed Oakite materials give improved results in pickling and neutralizing operations. 14

Flexible-Shaft Equipment

WALKER-TURNER CO., INC., 604 Berckman St., Plainfield, N. J. 8-page bulletin FS-41, on flexible-shaft machines—equipment for use in grinding, polishing, burring, etc., including bench and floor models, suspended models, etc. 15

Contour Sawing

CONTINENTAL MACHINES, INC., 1312 S. Washington Ave., Minneapolis, Minn. Handbook (158 pages) on contour sawing, giving complete information for operators and prospective users of contour sawing machines. 16

Automatic Thread Millers

LEES-BRADNER CO., Cleveland, Ohio. Catalogue entitled "Speed Thread Production," illustrating and describing the new Lees-Bradner Model 40 automatic thread miller designed for accurate, high-speed production. 17

Indicating and Control Instruments

WHEELCO INSTRUMENTS CO., Harrison and Peoria Sts., Chicago, Ill. Thermo-couple data book and catalogue (Bulletin S2-3), comprising a complete manual for thermo-couple users. 18

Electric Tools

INDEPENDENT PNEUMATIC TOOL CO., 600 W. Jackson Blvd., Chicago, Ill. Circular JE-112, entitled "The Fast, Modern Way to Drill," describing the company's latest type 1/4-inch capacity, light, one-hand electric drill. 19

Electric Salt Bath Furnaces

UPTON ELECTRIC FURNACE DIVISION OF THE COMMERCE PATTERN FOUNDRY & MACHINE CO., Melville Ave. at Green St., Detroit, Mich. 8-page bulletin 129-4, descriptive of heat-treating by electrothermic permeation. 20

Hydraulic Riveters

HANNA ENGINEERING WORKS, 1765 Elston Ave., Chicago, Ill. Folder describing a new portable hydraulic riveter with flexible suspension feature which permits easy changing from one riveting position to another. 21

Rotary Shears

QUICKWORK-WHITING DIVISION OF WHITING CORPORATION, 15673 Lathrop Ave., Harvey, Ill. Bulletin QW-100, descriptive of Quickwork-Whiting rotary shears for cutting both straight lines and irregular shapes. 22

Hydraulic Presses

FRENCH OIL MILL MACHINERY CO., Piqua, Ohio. Catalogue showing installations of different types of hydraulic molding and forming presses made by this company in a number of automotive and allied plants. 23

Carbide Tool Grinders

CARBOLOY COMPANY, INC., 11147 E. Eight Mile Blvd., Detroit, Mich. Bulletin giving complete specifications of the various types of Carboloy tool grinders, including information on adjusting and using these machines. 24

Welding Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet 26-200, describing a constant-potential, direct-current welding system for supplying welding energy to multiple-arc circuits. 25

Hydraulic Universal Grinders

CINCINNATI GRINDERS INCORPORATED, Cincinnati, Ohio. Catalogue G-474, illustrating and describing the new Cincinnati 14-, 16-, and 18-inch hydraulic universal grinding machines. 26

Dust Collectors

PANGBORN CORPORATION, Hagerstown, Md. Bulletin 907, descriptive of Pangborn unit type dust collectors, which are furnished completely assembled, ready for attachment to individual machines. 27

Synthetic Gear Materials

SYNTHANE CORPORATION, Oaks, Pa. Folder on silent stabilized Synthane Bakelite-laminated gear materials, giving convenient charts for the horsepower that can be transmitted by these gears. 28

Ampco Metal

AMPCO METAL, INC., Milwaukee, Wis. Catalogue 22, describing Ampco metal—an alloy of the aluminum-bronze class—and its use in industry for making parts subject to severe wear and corrosion. 29

Flexible Couplings

AMERICAN FLEXIBLE COUPLING CO., Erie, Pa. Catalogue 411, illustrating and describing the complete line of American flexible couplings, including two new types of couplings announced for the first time. 30

Utility Tool

TEMPLETON, KENLY & CO., 1020 S. Central Ave., Chicago, Ill. Circular illustrating and describing the Simplex "Util-A-Tool" for pulling, pushing, bending, and many other uses. 31

Grinding Carbide Tools

NORTON CO., Worcester, Mass. 64-page booklet on the grinding of carbide-tipped tools, comprising a handbook on the reconditioning and sharpening of single-point carbide tools rapidly and economically. 32

Spot-Facing and Boring Tool

BOKUM TOOL CO., 49 W. Hancock Ave., Detroit, Mich. Catalogue 341, describing the construction of a new spot-facing and boring tool especially designed to reduce the time required for these operations. 33

Defense Work Equipment

LINK-BELT CO., 307 N. Michigan Ave., Chicago, Ill. Book 1917, entitled "Just Another Job," illustrating and describing typical Link-Belt equipment for speeding defense work production. 34

Industrial Felt Products

BOOTH FELT CO., 434 Nineteenth St., Brooklyn, N. Y. Booklet entitled "The Technique of Felt Making," describing the procedure in manufacturing felt for a variety of industrial products. 35

Hydraulic Drives

TWIN DISC CLUTCH CO., 1324 Racine St., Racine, Wis. Bulletin 132, describing the design, performance, and typical applications of hydraulic clutches and hydraulic torque converters. 36

Universal Machine Head

JOHN KIS MFG. CO., Racine, Wis. Circular describing the construction and operation of the precision universal machine head made by this company for performing a variety of operations. 37

Vibration Isolation

LORD MFG. CO., Erie, Pa. Four-color vibration isolation chart of interest to designing engineers, showing percentage of vibration isolation obtainable in a flexibly mounted assembly. 38

Clamping Fixtures

KNU-VISE, INC., 16841 Hamilton Ave., Detroit, Mich. Catalogue showing twenty-two different models of toggle-action clamping fixtures, pliers, C-clamps, and drill jigs. 39

Control Equipment

BROWN INSTRUMENT CO., Wayne and Roberts Aves., Philadelphia, Pa.

Bulletin 89-14, descriptive of Brown control accessories for pneumatic controllers. 40

Gear-Hobbing Machines

BARBER-COLMAN CO., 203 Loomis St., Rockford, Ill. Circulars 19 and 20, containing job record data on the hobbing of film sprockets and planetary gears, respectively. 41

Die-Stocks and Portable Pipe and Bolt Machines

OSTER MFG. CO., 2073 E. 61st St., Cleveland, Ohio. Catalogue 41-A, covering Oster hand tools and portable pipe and bolt machines. 42

Plastics

GENERAL ELECTRIC CO., Pittsfield, Mass. 64-page booklet describing, step by step, how Textolite plastics are made, and giving, in chart form, their properties. 43

Integral Gear Units

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Folder F-8603, containing data on integral gear units for generators, compressors, pumps, lineshafts, etc. 44

Aluminum Melting Furnaces

FISHER FURNACE CO., 1740 N. Kolmar Ave., Chicago, Ill. Bulletin 300, illustrating and briefly describing the Fisher line of aluminum gas-fired melting furnaces. 45

Tachometers

BOULIN INSTRUMENT CORPORATION, 65 Madison Ave., New York City. Circular on Boulin centrifugal tachometers of hand and stationary types. 46

Honing Machines

MICROMATIC HONE CORPORATION, 1345 E. Milwaukee Ave., Detroit, Mich. Catalogue on Micromatic Hydrohoners with automatic Micr-O-Size control for high production. 47

Arc-Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Welder Specification Bulletin 338, illustrating and describing the new "Shield-Arc Jr." aircraft welding machine. 48

Universal and Tool Grinder

BROWN & SHARPE MFG. CO., Providence, R. I. Catalogue N13-86, descriptive of the B&S No. 13 universal and tool grinding machine and attachments. 49

Pipe and Bolt Machines

OSTER MFG. CO., 2073 E. 61st St., Cleveland, Ohio. Catalogue 41-B, illustrating and describing Oster heavy-duty stationary pipe and bolt machines. 50

Gear Pumps

WORTHINGTON PUMP AND MACHINERY CORPORATION, Harrison, N. J. Bulletin W-483-B1, descriptive of Worthington double-helical gear rotary pumps. 51

Electric Tools

WODACK ELECTRIC TOOL CORPORATION, 4627 W. Huron St., Chicago, Ill. Catalogue 45, on electric tools for construction, installation, production, and maintenance. 52

Air-Conditioning

AUTOMATIC REFRIGERATING CO., Hartford, Conn. Folder entitled "'Millionths' for Defense," showing how successful gagemaking requires controlled temperature. 53

Die Steel

JESSOP STEEL CO., Washington, Pa. Circular containing information on the properties, heat-treatment, and applications of Jessop C.N.S. air-hardening die steel. 54

Band Saws

WELLS MFG. CORPORATION, Three Rivers, Mich. Circular briefly describing the features of the Wells metal-cutting band saw, and illustrating its application. 55

Bearings

HARRIS PRODUCTS CO., 5424 Commonwealth Ave., Detroit, Mich. Folder giving engineering data and operating characteristics of "Torflex" flexible bearings. 56

Jacks

TEMPLETON, KENLY & CO., 1020 S. Central Ave., Chicago, Ill. Junior Catalogue 41, covering the Simplex line of jacks. 57

Electric Switches

ACRO ELECTRIC CO., 3167 Fulton Road, Cleveland, Ohio. Leaflet de-

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To Obtain Copies of New Trade Literature

listed on pages 153-156 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name ..... *Position or Title* .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

scribing a new type of snap-action switch for precision control. 58

Heat-Treating Baths

A. F. HOLDEN CO., New Haven, Conn. Booklet entitled "Ten New Ways to Save Time and Labor with Holden Heat-Treating Baths." 59

Tap Grinders

EDWARD BLAKE CO., 634 Commonwealth Ave., Newton Center, Mass. Folder completely describing the line of J-B tap grinders. 60

Honing Equipment

SUNNEN PRODUCTS CO., 7940 Manchester Ave., St. Louis, Mo. Bulletin on precision honing equipment for internal honing. 61

Industrial Brake Equipment

WAGNER ELECTRIC CORPORATION, 6400 Plymouth Ave., St. Louis, Mo. Bulletin IU-20, on industrial brake equipment. 62

* * *

In recognition of continuous service with the company for ten to twenty-five years, the Farrel-Birmingham Co., Inc., of Ansonia, Conn., and Buffalo, N. Y., recently awarded service emblems to 577 employes. A sterling silver service pin was awarded to 139 employes who had completed twenty to twenty-five years, while 438, who had completed ten to twenty years, received bronze emblems.

Blast Cleaning Aids in Obtaining Piston-Pins of Uniform Hardness

The Burgess-Norton Mfg. Co., Geneva, Ill., maker of automotive parts and screw machine products, uses an airless, abrasive-blast, tumbling type cleaning machine such as built by the American Foundry Equipment Co., Mishawaka, Ind., for removing the scale from the holes of piston-pins. The company manufactures a great many piston-pins with holes from 1/2 inch to 2 inches in diameter. The removal of scale from these holes formerly presented considerable difficulty, but through the installation of the cleaning machine mentioned, known by the trade name "Wheelabrator," the problem was solved. Not only did this method of cleaning eliminate two grinding and lapping operations, but another unexpected advantage was discovered.

After the pins have been cleaned in the abrasive-blast machine, it is possible to detect readily any soft spots in the pins, a condition that is frequently met with, since the great majority of these piston-pins are made from low-carbon, case-hardened steel. These soft spots appear clearly in relief on the surface after the abrasive-blast cleaning operaion, because the steel grit abrasive roughs up the surface of the soft spots to a considerably greater extent than the harder portions of the pin. This rougher surface appears as a different shade of gray, thereby making the detection of soft spots comparatively easy with the naked eye.

As a result of the appearance of the soft spots in the pins, the inspection has become so simple and positive that the manufacturer can eliminate any that are not of uniform hardness throughout, and thereby furnish an improved product.

Trade School Opened by Continental Machines, Inc.

Continental Machines, Inc., Minneapolis, Minn., announces that the company has just opened what is known as the DoAll Trade School, intended to give one, two, or three months' courses in machine tool operation. The curriculum is planned to aid in filling the urgent need for machine tool operators by training both beginners and experienced men in modern methods. The training shop is equipped with lathes, shapers, milling machines, surface grinders, and DoAll contour machines. The actual machine shop experience is being supplemented by the use of a ten-reel industrial sound film which covers the study of chip formation; die, jig, and fixture making; and basic information about machine tools. J. T. Thompson is director of the school.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 157-178 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description on pages 157-178—or write directly to the manufacturer, mentioning machine as described in September, 1941, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 150-151, fill in below the identifying number found at end of each description on pages 150-151—or write directly to the manufacturer, mentioning name of material as described in September, 1941, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Lees-Bradner Automatic Thread-Miller

An automatic thread-milling machine designed to produce internal and external threads of the utmost precision at a high rate of speed has just been brought out by the Lees-Bradner Co., Cleveland, Ohio. This machine, known as the Model 40, generates threads by the ring or hob type process in but one and a fraction revolution of the piece being threaded. With this machine it is only necessary for the operator to load and unload the machine and actuate the starting lever, all other functions of the machine being performed automatically. The new machine is adapted for threading a wide variety of work that can be gripped in a chuck, and is now being used for threading operations on 0.30- and 0.50-caliber machine-gun components, shells, aircraft engine parts, variable-pitch propeller parts, aircraft landing-gear mechanisms, automatic rifle parts, machine tool parts, and many other kinds of work that must be threaded accurately at high production rates.

The features of the machine include a bed and pan constructed in one piece; wide, well covered ways; separate motor-driven coolant pump; and separate interlocked work-head and cutter-head driving motors. The work-head can be adjusted about a vertical axis to compensate for any small taper inaccuracies in the cutter. The work-head motor is mounted directly on the head. A solenoid-operated shoe brake with provision for adjustment is furnished for use in the generation of registered threads and to avoid excessive coasting. Although fully automatic in operation, the machine has only two clutches in the work-head, one the positive-jaw feed-clutch, and the other the multiple-disk friction type rapid-traverse clutch. Both of these clutches are readily accessible for minor adjustments.

The work-head spindle is driven by a precision worm and worm-wheel, and has provision for mounting collets, three- or four-jaw chucks, or other work-holding fixtures. Pick-off gears for obtaining a wide range of work-spindle speeds are standard equipment, which also includes a set of sixteen feed and automatic cycle gears, a two-step cutter-head drive to give 300 and 450 R.P.M. of the cutter with a 1200-

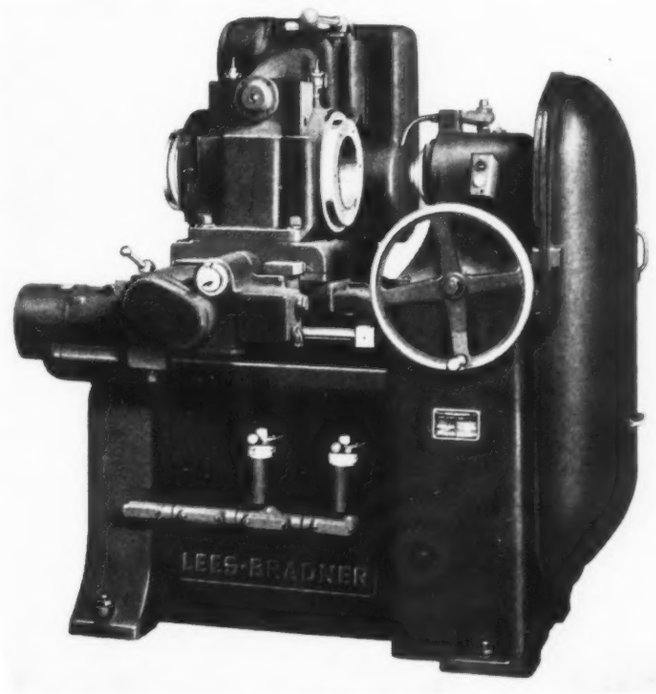


Fig. 1. Lees-Bradner Automatic Thread-miller Developed for High-speed Production of Precision Threads

Fig. 2. Rear View of Lees-Bradner Model 40 Automatic Thread-milling Machine

To obtain additional information on equipment described on this page, see lower part of page 156.

R.P.M. motor, a master screw and nut, and a coolant pump. The motor equipment, to be supplied by the customer, includes a 1-H.P. and a 1 1/2-H.P. motor, both of which should be of the NEMA open type.

The maximum distance from the nose of the cutter-spindle to the nose of the work-spindle is 12 inches, and the minimum distance 1/2 inch. The maximum work-spindle speed is one revolution in 20 seconds, and the minimum speed one revolution in 3 minutes, when a 1200-R.P.M. motor is employed. Additional gears are available which will give maximum and minimum speeds of one revolution in 15 seconds and one revolution in 6 minutes.

The maximum diameter of work on which external threads can be milled is equal to 9 inches minus the diameter of the cutter, and the maximum diameter of work on which internal threads are to be milled is equivalent to 4 inches plus the cutter diameter. The swing capacity over the ways is 18 inches. The cutter-spindle is arranged to receive shank type cutters or cutter-arbors having a No. 10 B&S taper, but other tapers can be furnished. The hole through the work-spindle is 6 1/2 inches in diameter. The floor space required by the machine is 4 feet 6 inches long by 3 feet 2 inches wide. The machine weighs 3325 pounds. 71

Murchey Thread-Milling Machine

The Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich., has brought out a single-spindle thread-milling machine (No. 32) which is intended for the mass production of right- or left-hand internal or external threads from 1 inch up to 4 inches in diameter, inclusive, and 3 inches in length, by means of annular milling cutters which cover the full length of the thread in one revolution of the work.

The machine illustrated is used to thread the base end of 3-inch anti-aircraft shells. The thread produced in this shell is left-hand, 2 7/16 inches in diameter, 16 threads per inch, and 5/8 inch long. This thread is cut tight to a shoulder. The production with this equipment is 73 finished threads per hour.

The milling hob used with this machine is revolved eccentrically about the work in which the thread is to be cut, and is simultaneously rotated on its own axis until the cutting teeth are advanced into the work for a sufficient distance to produce the full depth of thread, after which the cutter, continuously rotating on its own axis, is carried around the work and simultaneously advanced axially by means of a lead-screw to produce the helical thread.

The cutter-spindle, after completing the milling operation, is automatically returned to the center, permitting facing or counter-boring operations to be performed with the assurance that the surfaces thus machined will be concentric with the thread. The motors, starter, Reeves flexible pulley unit, lubricating and cooling system, and hydraulic equipment are all enclosed. The fixture table has a 30-inch bearing on the ways and adjusting taper gibs the full length. This table is provided with two T-grooves and one keyway, the keyway being used for locating purposes only, while the T-grooves are employed to bolt the fixture to the table. A space of 8 inches between the top of the carriage table and the center line of the spindle provides room for a threading fixture for practically any size work.

To change the pitch from right- to left-hand threads, or vice versa, it is only necessary to change the lead-screw and segmental lead-nuts and the milling hob or milling head. The machine is so designed that these parts are accessible, permitting the complete change to be made in thirty minutes or less. 72

Eclipse Electric-Eye Operated Sprayer

An automatic shell-spraying machine with electric eye control has been developed by the Eclipse Air Brush Co., Inc., 400 Park Ave., Newark, N. J. This machine coats both the inside and outside of projectiles in one operation.

Fig. 1. Single-spindle Thread-milling Machine Built by the Murchey Machine & Tool Co.

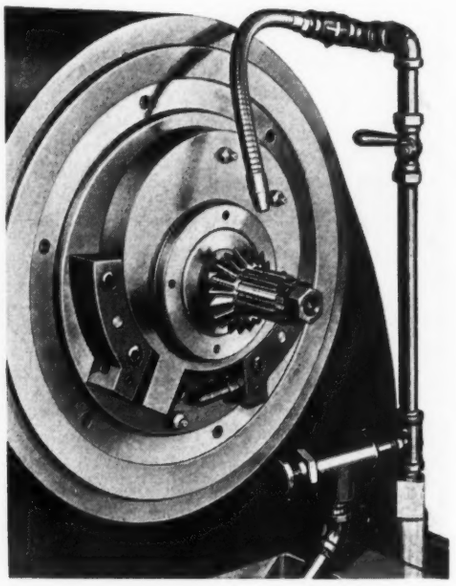


Fig. 2. Close-up View of Cutter Used on Murchey Thread-milling Machine

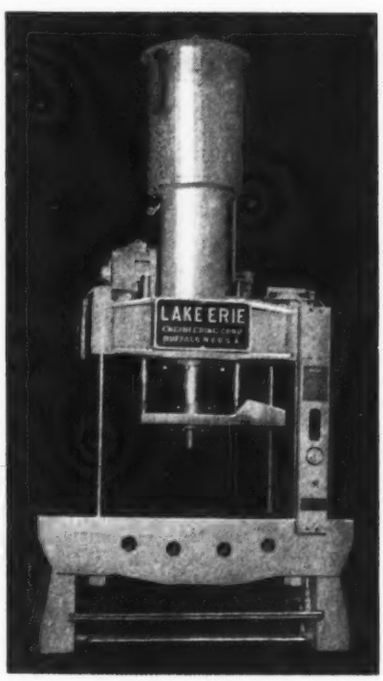
To obtain additional information on equipment described on this page, see lower part of page 156.

The shells are placed on the indexed turntable manually, and are then carried around to a position in front of automatic spray guns that coat the outside while an extension nozzle on another gun comes up to spray the inside. The action of the guns is controlled by an electric eye device, so that there is no spray unless a shell is in the holder. After being sprayed, the shells enter a steam-jacketed oven which is built over the back of the table. When they emerge from the oven, the projectiles are removed by the operator. This machine will handle 75-millimeter armor piercing shells at the rate of 500 an hour. 73

Lake Erie Hydraulic Straightening Press

A 100-ton hydraulic press designed for straightening light armor plate and bars has been brought out by the Lake Erie Engineering Corporation, Buffalo, N. Y. This type of press, with its control of pressure, provides means for straightening plate that has become distorted or warped from heat-treatment.

The press is self-contained, with the pumping unit mounted on top. Working space accessible from all four sides provides for speed and convenience in handling the material and correct spacing of supporting blocks on the working surface of the bed. 74



Lake Erie Press for Straightening Light Armor Plate and Bars

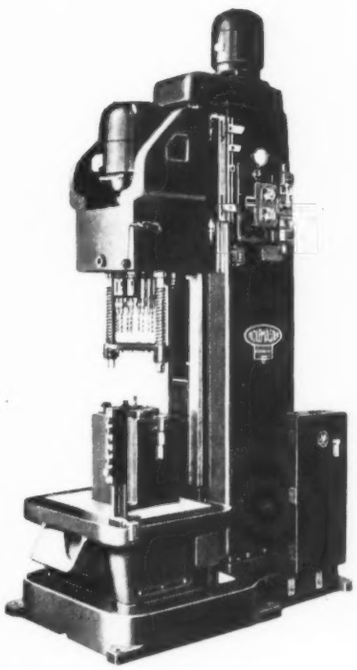


Fig. 1. Bradford "Holemaster" Equipped with Two-speed Multiple Head

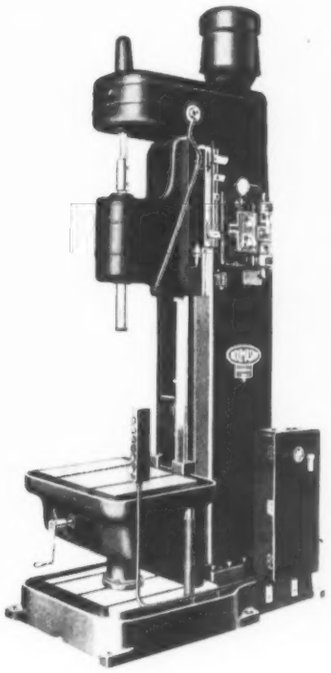


Fig. 2. "Holemaster" Single-spindle Machine Equipped with Adjustable Table

Bradford "Holemaster" Drilling and Boring Machines

A new "Holemaster" hydraulic drilling and boring machine has recently been added to the line of equipment manufactured by the Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. This drilling machine, equipped with a special two-speed multiple head, a stationary table, and a neck which carries the hydraulic pump, is shown in Fig. 1. The method of mounting the motor for the cluster-box drive is also shown in this illustration. Fig. 2 shows a single-spindle type machine arranged with geared neck and one motor for driving both the spindle and the hydraulic pump. This machine is shown equipped with an adjustable knee type table which can be obtained, if desired, in place of the stationary table, with which it is interchangeable.

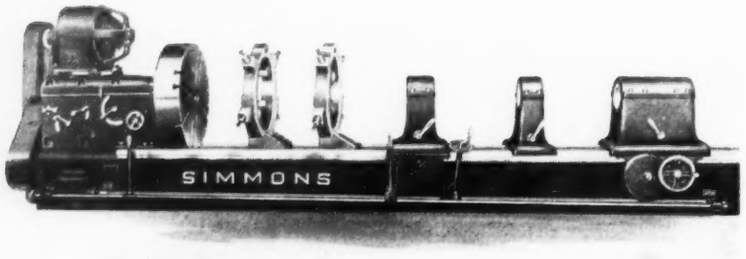
These Holemaster drilling and boring machines are provided with electrically operated and controlled hydraulic feeds. They are built in a complete range of sizes from 5 to 30 H.P. capacities, and are constructed from standardized machine elements. The standard elements can be arranged in various combinations to obtain almost any type of drilling or boring machine. Should the work be changed after these machines have been installed, the elements can be rearranged to change the machine from one type to another.

The lower section of the column encloses the counterweights, and openings are provided for adding and removing auxiliary counterweights to suit the drilling equipment. The upper section of the column forms the oil reservoir for the hydraulic system. The control panel is bolted to the right-hand side of the upper section of the column, and all the piping is concealed within the oil reservoir, eliminating long lengths of piping and yet providing easy accessibility for servicing.

The geared neck provides two changes of speed and neutral through a clutch actuated by means of a lever located on the right-hand side of the machine. The neutral position permits the drive-shaft rotation to be stopped when making set-ups. A delayed reverse can also be furnished which provides a dwell at the end of the feeding stroke for accurate facing to depth.

The stationary table is designed to support large work-holding fixtures under heavy loads. It is furnished with chip chutes, strainers, and clear-out hole for removing chips. A wide coolant channel drains into the machine base. 75

To obtain additional information on equipment described on this page, see lower part of page 156.



Heavy-duty Boring Lathe Brought out by the Simmons Machine Tool Corporation

Simmons Heavy-Duty Boring Lathe

The Simmons Machine Tool Corporation, 1600 N. Broadway, Albany, N. Y., is manufacturing a 54-inch heavy-duty lathe with a massive bed especially designed for maximum strength and to provide ways with wide bearing surfaces. The headstock, of simplified design, is fully enclosed, and all bearings and gears are constantly lubricated by a positive-pressure oil-pump which delivers filtered oil. Either six or four speed changes are provided for the internal faceplate through sliding spur-tooth gears and one heavy jaw clutch. A direct-reading chart shows the selection of spindle speeds. Power rapid traverse is connected to the feed-screw through sliding gears that provide means for moving either the front or rear bar support at speeds up to 25 feet per minute.

The boring-bar tailstock is designed for boring long holes of large diameter. A handwheel is provided for setting the tailstock manually to the required position, and a single lever engages the driving nut for both the feed and power rapid traverse. The head bar support contains a driving unit similar to the tail support which can be used for feeding short boring-bars and also for rapid power traverse of the unit. A complete remote and power traverse control is mounted on the bar support. The spotting carriage is optional equipment, and is so designed that it can be removed from under the work and bar after the steady-rest is in place and boring started.

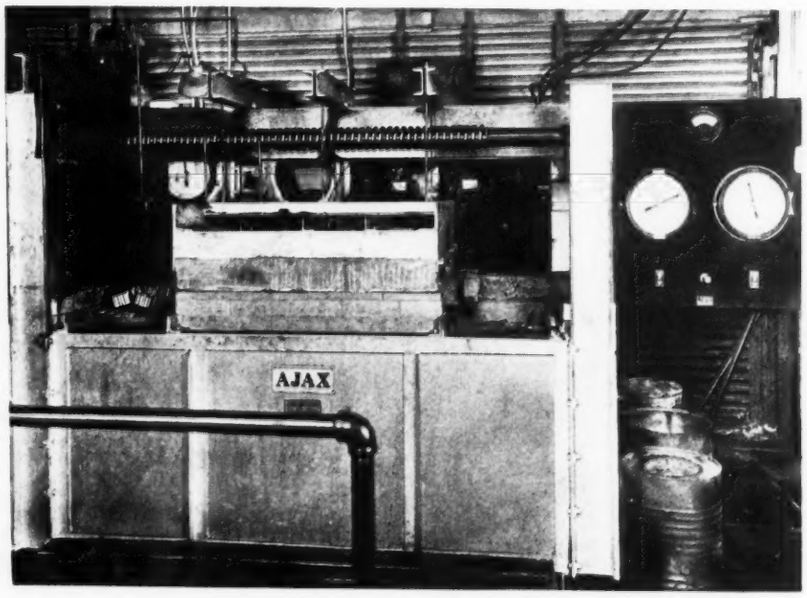
The swing is 55 1/2 inches over the bed, and 42 inches over the carriage. The maximum boring length at one setting with a 40-foot bed is 13 feet. Spindle speeds for the four-speed headstock with a 400- to 1600-R.P.M. direct-current motor range from 1.6 to 50 R.P.M.; and with a 500- to 1500-R.P.M. direct-current motor, from 2 to 48 R.P.M. Speeds for the six-speed headstock with a 900-R.P.M. alternating-current motor range from 3.6 to 29 R.P.M.; and with a 600-R.P.M. alternating-current motor, from 2.4 to 19 R.P.M. With a 1200- and 600-R.P.M. two-speed alternating-current motor, the range is from 2.4 to 38 R.P.M.; and with a 900- and 450-R.P.M. two-speed alternating-current motor, 1.8 to 29 R.P.M. The hole through the spindle is 2 3/4 inches in diameter, and the taper of the centers is Morse No. 7. The maximum diameter of the boring-bar is 8 inches, and the diameter of the feed-screw 4 1/2 inches. A motor of 30 to 50 H.P. is recommended. 76

Ajax Conveyor-Equipped Electric Salt Bath Furnaces

Completely conveyor-equipped electric salt bath furnaces for casehardening alloy steel parts are being manufactured by the Ajax Electric Co., Inc., Frankford and Delaware Aves., Philadelphia, Pa. The 90-kilowatt furnace illustrated has been installed in a Midwest automotive plant for heating an activated cyanide bath to produce case depths ranging from 0.001 to 0.050 inch on alloy steel parts. It is equipped with a slotted cover to minimize loss of heat by radiation.

Larger units of this mechanized type are made for all heat-treating operations from 300 to 2400 degrees F., including simultaneous brazing and carburizing, tempering, hardening the new molybdenum high-speed steel tools, annealing, brazing, and heating for forging. The steel parts submerged in the bath travel through the furnace at a controlled speed for the duration of the heat-treating period, during which high temperatures are held virtually constant to within a few degrees.

These furnaces are of the resistance type, in which the molten heat-treating salt is itself the conductor, being heated by its own resistance to an electric current. Molten salt within a small area between pairs of electrodes is, in fact, the only heating element. A step-down transformer supplies a high-amperage alternating current at 5 to 25 volts. Current between the electrodes produces a powerful electromotive field in the bath that pulls the salt downward with a swirling motion, causing the continuous stirring action characteristic of these furnaces. This action serves to disperse the heat evenly throughout the bath. 77



Conveyor-equipped Salt Bath Furnace Manufactured by the Ajax Electric Co.

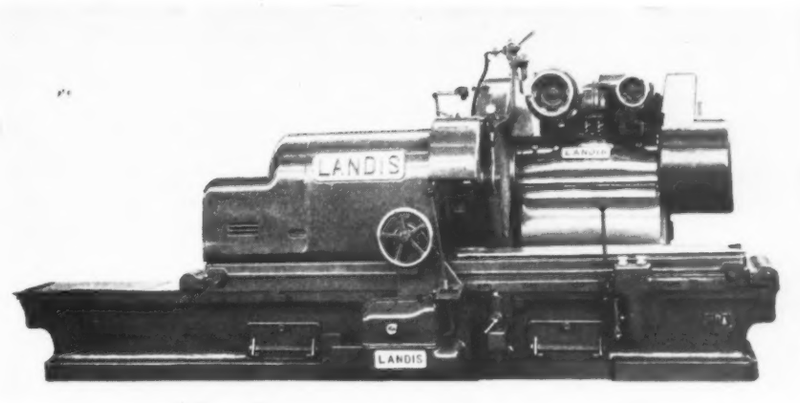
To obtain additional information on equipment described on this page, see lower part of page 156.

Swiss Type Automatic Screw Machine

An American-built automatic screw machine of the Swiss type is now being placed on the market by the Triplex Machine Tool Co., 125 Barclay St., New York City, who has been distributor for the Swiss-Bechler machines in the United States and Canada since 1929.

This machine has a capacity for handling 3/8-inch round stock, performing turning operations up to 1 1/2 inches in length with a flat feed-cam or up to 2 3/4 inches long with a bell type cam. This is a single-spindle type machine in which the stock is fed forward through an adjustable guide bushing while being machined by radially positioned tools. The four tool-slides for turning, forming, and cutting off are placed immediately ahead of the guide bushing, so that the overhang is kept to a minimum at the cutting point, regardless of the length turned.

For spot-centering, drilling, and right-hand threading, an attachment is provided that successively swings three cutter-spindles in line with the work axis. Separate axial feed is provided for these tools. There is also available a single-spindle right-hand threading attachment. In addition, a screw-slotting attachment can be furnished. The machine is motor-driven, providing speeds up to 6100 R.P.M. The cams, of simple design, can be easily set up, and the camshaft is readily accessible at the rear. 78



Landis Radial Crankshaft Grinder with Hydraulic Power Traverse for the Work-table

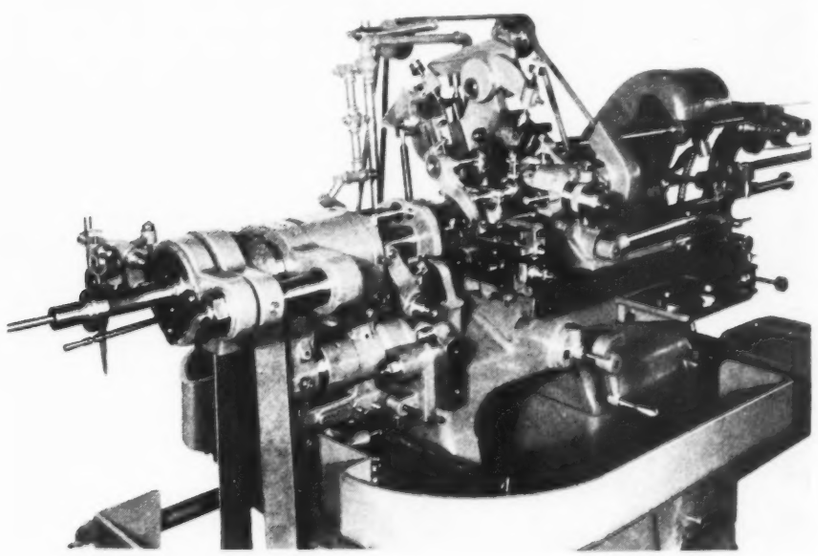
Landis Radial Crankshaft Grinder

The Landis Tool Co., Waynesboro, Pa., has recently developed a 25-inch swing, Type D radial crankshaft grinder of specialized design. When equipped with the proper tools this machine is suitable for a variety of operations, including rough-grinding crankshaft pins and their adjoining radii; squaring the ends of the center section of crankshafts; grinding the web faces adjoining the pins of the center section; squaring the ends of the pins on both the front and rear sections; grinding the web faces adjoining the pins on both the front and rear sections; semi finish-grinding the pin and adjoining radius on both the front and rear sections; and finish-grinding the pins and adjoining radii after assembly of shaft.

The large hollow spindle will take either the long or the short end of a radial crankshaft for the finish-grinding operations after the shaft has been assembled. A grinding wheel 42 inches in diameter is used. The work speed ranges from 30 to 55 R.P.M. on the standard machine. The straight in-feed is accomplished by means of a hydraulic mechanism. A lateral feed rather than a straight in-feed is used for grinding the web faces.

A lever controls the direction of the feeding movement, while a valve regulates the speed of the slow or dressing feed. A second valve permits a quick shift from slow to fast feed, or vice versa. A visual sizing gage, mounted at the rear of the work-head, enables the operator to check the progress of the pin-grinding operation. A shoulder-grinding attachment permits feeding the grinding wheel laterally after it has been brought into the grinding position by a handwheel. The amount of feed is adjustable, and can be set for continuous duplication.

A 1-H.P. work-driving motor, a 3-H.P. pump-driving motor, and a 15- to 25-H.P. wheel-driving motor are recommended. The floor space required by the machine is 8 feet 10 inches by 16 feet. The weight is 22,200 pounds. 79



Automatic Screw Machine Placed on the Market by the Triplex Machine Tool Co.

Electrode Holder of Improved Design

An electrode-holder having special alloy metal jaws designed for better heat resistance, more secure grip on the electrode when held at any angle, and the assurance of better electrical connection with the

To obtain additional information on equipment described on this page, see lower part of page 156.

electrode has been brought out by the US Electric Welder Corporation, 1224 W. Bancroft St., Toledo, Ohio. It is claimed that this holder will not break if dropped, and that it will permit easy access to small work without the danger of "shorting" the jaws on the work. The extended lever on the upper jaw is designed to permit the operator to release the stub of used electrode without changing the position of the hand on the handle or requiring the use of both hands. 80

Hanna Portable Hydraulic Riveter

A unique suspension method that permits changing easily and quickly from one position to another is an important feature of a new portable hydraulic riveter manufactured by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. The suspension equipment is so designed that the riveter is free to rotate or tilt into any position without interference from the hydraulic hose or suspension members. This flexibility assures maximum speed in driving rivets in any position.

A push-button on the riveter initiates the automatic riveting cycle, causing the rivet die to advance rapidly at low pressure until it comes in contact with the rivet. The pressure then increases as the rivet is driven. Reversal of the die occurs the instant the rivet is driven, and the return to its starting position is rapid. This cycle of operations is entirely automatic.

Essential safety features permit the operator to reverse the stroke instantaneously and automatically prevent repeat strokes. The pressure exerted by the riveting die can be regulated by simply turning the tonnage control dial. Recommended pressures for driving rivets of various diameters and different types of heads are embodied in the instruction plate. The riveter automatically adjusts itself to variations in the thickness of the work.

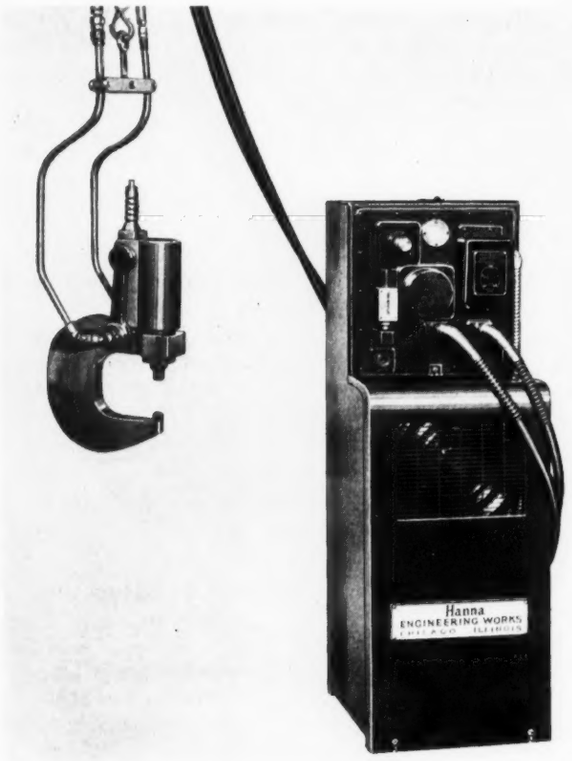
The ram pressure capacity is 17 1/2 tons, and the ram stroke 3 inches. Cold rivets up to 3/8 inch in diameter and hot rivets up to 5/8 inch in diameter can be driven. The self-contained power unit is completely enclosed, a high-pressure pump, belt-driven by a 2-H.P. horizontal motor, being employed. The pump, relief valve, pressure gage, tonnage adjustment, oil-level gage, oil filter, motor starting switch, and piping are all mounted on a single panel, which can be quickly removed as a unit. The power unit requires a floor space of approximately 17 by 20 inches.

Standard C-frame yokes are available with a 4-inch reach and 6-inch gap; 6-inch reach and 6-inch gap; 8-inch reach and 8-inch gap; 10-inch reach and 8-inch gap; and 12-inch reach and 8-inch gap. 81

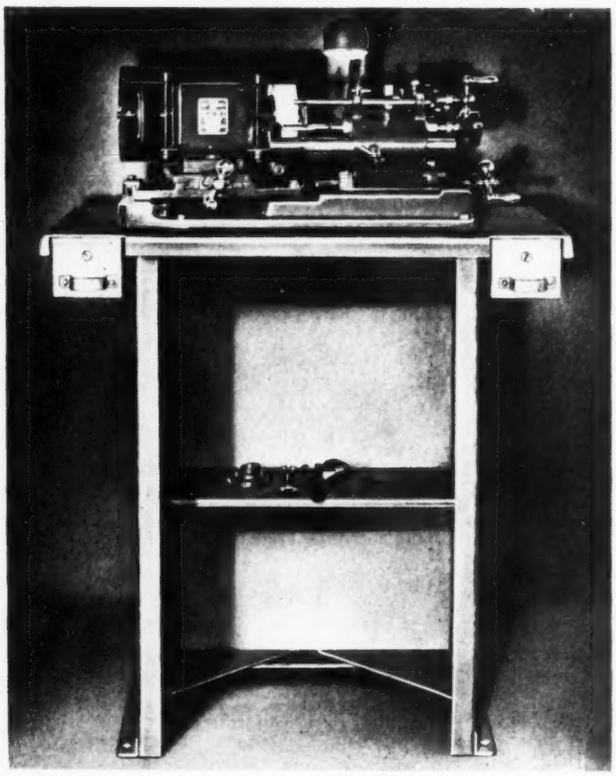
Blake Tap Grinders and Pedestal

The Edward Blake Co., 634 Commonwealth Ave., Newton Center, Mass., is bringing out a new No. 1 and No. 2 J-B tap grinder and a J-B tap-grinder "knee room" pedestal. The tap grinders are designed for sharpening right- and left-hand taps on the chamfer, and regularly accommodate taps with two, three, four, and five flutes, but can be equipped for grinding taps with six, eight, and ten flutes.

The No. 1 J-B tap grinder will hold taps on the outside diameter of the thread in any length and in sizes from No. 0 to 1/2 inch; taps held on the shank in any length and in sizes from No. 0 to 5/8 inch; and taps held on centers in lengths under 5 inches and in sizes from No. 0

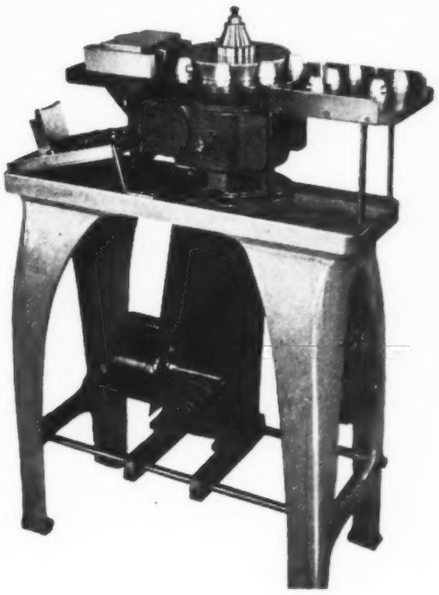


Hanna Portable Hydraulic Riveter and Power Unit

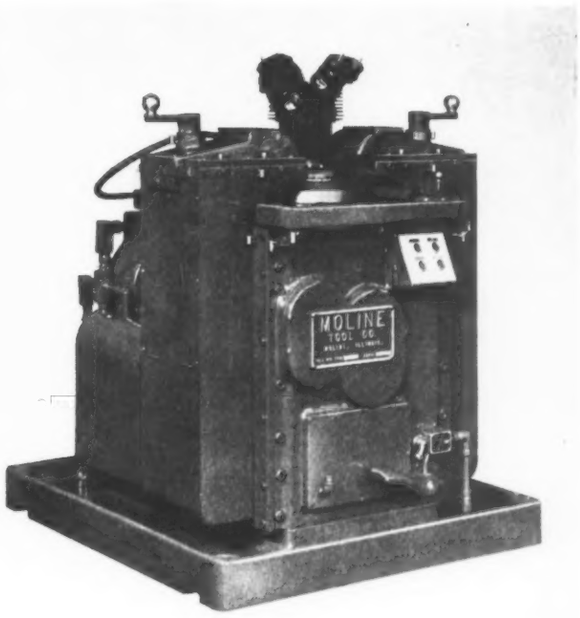


Blake Tap Grinder Mounted on "Knee Room" Pedestal

To obtain additional information on equipment described on this page, see lower part of page 156.



Production Numbering Machine Built by Wm. A. Force & Co. for Marking Conical Fuse Caps



Moline Miller for Back-facing Bolt Holes in Flanges of Radial Engine Cylinders

to 2 inches. The No. 2 J-B tap grinder is similar to the No. 1, except that it is furnished with a 10-inch extended base for sharpening the chamfer on taps up to 12 inches in length held on centers.

Taps can be inserted in or removed from the machine in a few seconds, and a simple locating device insures correct positioning and duplication of work. The desired relief is obtained by a simple screw adjustment of an eccentric mechanism. The motor-head unit can be swiveled in a wide arc to any desired chamfer angle.

These tap grinders are furnished complete with motor, two grinding wheels, wheel guards, diamond wheel-dresser, wrenches, and draw-in master collet, and two bell centers. The new J-B grinder pedestal is available as optional equipment. It has two drawers for storing extra bushings and tools. 82

Production Numbering Machine

Wm. A. Force & Co., 216 Nichols Ave., Brooklyn, N. Y., have just completed a battery of eleven power-driven rotary marking machines for the Proctor & Gamble Defense Corporation. These new machines are to be used for numbering and marking conical fuse caps. Using a turntable as an anvil, the caps are rolled across the face of a standard indenting marking head made by this company, which provides space for interchangeable steel marking dies.

The machine is driven by standard motors, and the speed is governed by standard reduction gears. For ordinary numbering and marking, speeds of over 5000 pieces per hour can be maintained by comparatively inexperienced operators. When numbers are required to register accurately in given positions, the speed is reduced to some extent, but the machines will still turn out over 1500 pieces per hour. 83

Welded Composite Steel Blanks for Forming Cutters

The Forging and Casting Corporation, Ferndale, Mich., has developed a new line of electrically welded composite steel blanks for use in making dovetail forming cutters for automatic screw machines. The blanks are made by a special process in which a cutting face of high-speed steel is electrically welded to a non-hardenable base of mild steel. This procedure reduces, by at least one-half, the quantity of high-speed steel required for a tool of a given size, resulting in a proportionate saving in tungsten.

An advantage of these tools is that the non-hardenable tough base minimizes the tendency to break out at the sharp dovetail corners or at the fastening-screw holes during heat-treatment or when under excessive strain in cutting metal. ...84

Moline Miller for Back-Facing Bolt Holes in Cylinder Flanges

The Moline Tool Co., Moline, Ill., has recently developed a No. 24 miller for back-facing bolt holes in the flanges of radial engine cylinders. The driving gears and cams of this machine are enclosed, and all rotating members are lubricated by a force-feed system. Cutting fluid is delivered to the cutters from a reservoir which is cast in the machine column.

This machine is semi-automatic in operation. After loading the fixture, the operator moves the cutters into position over diametrically opposite holes by means of hand-levers. The operating cycle is started by pressing a push-button, which brings a driving spindle up into each of the two cutters to rotate them during the feeding cycle. After the cycle is completed and the drivers have automatically withdrawn from the tools, the work is indexed by the operator and the next pair of holes is faced.

The indexing movement takes place without manual withdrawal of the cutters. Withdrawal of the cutters by means of the hand-levers is necessary only before the work is removed from the fixture. Interlocking of the electrical control with the mechanical features prevents the feeding cycle from starting unless the work is properly indexed. .85

To obtain additional information on equipment described on this page, see lower part of page 156.

Van Norman Automatic, Bed Type Milling Machine

An automatic, bed type milling machine equipped with hydraulic table feed, developed for the high-production milling of small- and medium-sized parts, has been added to the line of the Van Norman Machine Tool Co., Springfield, Mass. Automatic table cycle, automatic spindle stop, rigid construction, and ease of operation are features incorporated in this new Model 118 machine. The normal cycle of operations consists of rapid-traverse advance, milling at normal feed, and automatic rapid-traverse return to the starting position. By employing additional table dogs, however, it is possible to obtain skip-stop table cycles.

The spindle transmission, located in a compartment at the rear of the bed, is driven by a 3-H.P. motor, hinge-mounted to facilitate belt adjustment to the main drive pulley. Spindle speed changes are obtained through pick-off gears accessible in a housing at the rear. Either left- or right-hand rotation of the spindle is effected by the movement of one lever. Spindle drive gears in a housing on the quill are provided with a high-low series, the selection of either range being obtained through a lever. The spindle speed plate on the door of the pick-off gear housing shows the gear combinations required to obtain any of the twelve speeds, arranged in geometrical progression from 30 to 1000 R.P.M.

The spindle clutch, located in the spindle transmission compartment, is operated hydraulically by means of a lever located in a panel at the right of the front side of the machine. Engagement of this lever instantly starts or stops the spindle. The machine can be furnished with an automatic spindle stop which provides for automatic engagement and disengagement of the spindle in relation to the travel of the table. With this feature, it is possible to start the spindle automatically when the main operating lever is thrown to the rapid advance position. The spindle automatically stops when the table is reversed.

The general specifications of the machine are as follows: Working surface of table, 34 by 10 inches; longitudinal power feed of table, 18 inches; table feed range, 1/2 inch to 40 inches per minute; rapid traverse, 200 inches per minute; vertical movement of spindle-head slide, 17 1/2 inches, with a minimum of 2 3/4 inches from top of table to center line of spindle. The quill has a 3 1/2-inch cross-adjustment within a minimum of 3 inches from the center line of the table to the face of the spindle. The machine occupies a floor space of 65 by 46 inches. It weighs 3600 pounds. 86

Automatic, Bed Type Milling Machine Developed by the Van Norman Machine Tool Co.

Cincinnati Hydraulic Universal Grinding Machines

A new line of universal grinding machines built in 14-, 16-, and 18-inch swing, with 36-, 48- and 72-inch between-center lengths for each swing, has been brought out recently by Cincinnati Grinders Incorporated, Cincinnati, Ohio. The machines in this line embody features similar to those incorporated in the smaller 12-inch machine described in March, 1940, MACHINERY, page 143.

The table of the new machines is hydraulically traversed, the stepless variable traversing rate ranging from 3 to 220 inches per minute. The power table movement can be adjusted for a minimum stroke of 3/32 inch. The accuracy of the automatic reversal is held within 0.004 inch. This permits power grinding exceptionally close to shoulders without danger of spoiling the work. The hand table traverse has two mechanically controlled speeds—1/10 inch per turn of the handwheel for close adjustment and for grinding shoulders, and 15/16 inch per turn for setting up. Hand Servo power control, desirable when frequent hand traversing of the table is necessary, can be obtained as extra equipment.

The main grinding wheel spindle runs in Filmatic bearings. Oil under a definite pressure completely fills the bearing compartment, and the spindle cannot rotate until this pressure is attained. Conversely, the spindle-drive motor automatically stops if the oil supply should fail or diminish.

The wheel-head can be swiveled 90 degrees right and left. A 5-H.P. motor mounted on top of the wheel-head unit drives the grinding spindle through V-belts. A hinged type bracket at the front of the wheel-head contains the internal grinding quill and spindle. This construction permits concentric external and internal work to be accurately ground in one setting.

The headstock is equipped with a new type drive known as the "Speed Ranger." By merely turning a handwheel, an infinite number of speeds ranging from 25 to 225 R.P.M. can be obtained. An optional range of 40 to 360 R.P.M. is available. Graduations on the base of the unit cover a swivel range of 90 degrees forward and 30 degrees to the rear. A quick-change device for live or dead spindle operation is incorporated in the unit. The hand cross traverse has a two-speed arrangement giving 0.050 inch feed per turn of the hand-

To obtain additional information on equipment described on this page, see lower part of page 156.

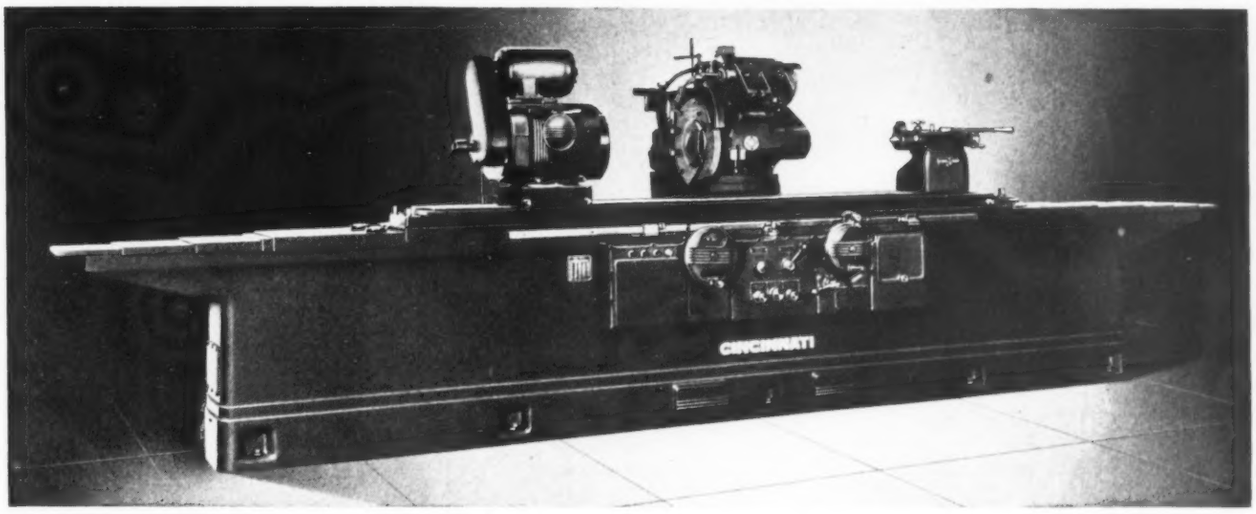


Fig. 1. Front View of Cincinnati 16- by 72-inch Hydraulic Universal Grinding Machine

wheel in low gear and 0.250 inch per turn in high gear. Graduations on a rim at the back of the handwheel are provided for repetitive multiple-diameter grinding work. A reduction in diameter as small as 0.0001 inch can be obtained by hand adjustment. Automatic pick feed can be set for one to seven notches on the cross-feed handwheel, reducing the work diameter 0.0004 to 0.014 inch.

All controls, including electrical push-buttons, are closely grouped. The work rotation and coolant flow are automatically started and stopped with the table-traverse control lever. The 14- by 36-inch machine weighs 7500 pounds, and the 18- by 72-inch machine 10,000 pounds, including motors and controls. 87

Ozalid Automatic Whiteprint Machine

Synchronized printing and developing to insure fast production of prints is accomplished by the new Model C automatic whiteprint machine brought out by the Ozalid Products Division of General Aniline & Film Corporation, Johnson City, N. Y. This combination printing and developing unit is synchronized to print and develop Ozalid sensitized materials at speeds up to 12 1/2 feet per minute.

It is designed to operate continuously to meet peak periods of production, and is constructed for either front or rear delivery of prints. This

Fig. 2. Grinding the Bore in a Large Sleeve Gear on New Cincinnati Universal Grinding Machine

Ozalid Synchronized Printing and Developing Machine for Making Whiteprints

To obtain additional information on equipment described on this page, see lower part of page 156.

allows the operator to feed the original and sensitized material into the front of the machine and receive the finished prints either on a delivery tray at the front or on a sorting table at the rear.

An automatic device separates the sensitized material from the original, automatically removing the original from the machine after it has come through the printer and allowing the printed material to be carried through the developer. A blower removes hot air from the printing cylinder, cools the burner, and creates the vacuum required for the automatic separator. The machine accommodates materials up to 42 inches wide. 88

Tumbling Equipment for Finishing Machine Gun Parts

A "Mercil" oblique barrel type of tumbling equipment for finishing or cutting down machine gun parts has been brought out by the Hanson-Van Winkle-Munning Co., Matawan, N. J. The tumbling barrel is said to give a much better finish than is obtained with hand-filing.

The cast-iron tumbling barrels are octagonal in shape, 13 3/4 inches deep, with a 5 1/4-inch opening at the top, and approximately 9 1/2 inches across the flats. The cylinders, driven by a 1/2-H.P. motor, are raised and lowered by means of a lever. Directly under the cylinders is a sump or drain tank and a perforated tray or basket. The operator unloads the contents of the cylinders into this tray and then flushes it out with a hose, the water and residue passing into the sump tank beneath. The small machine parts are run with silica sand and oil from two to four hours, depending on the size of the load and the size of the pieces. 89

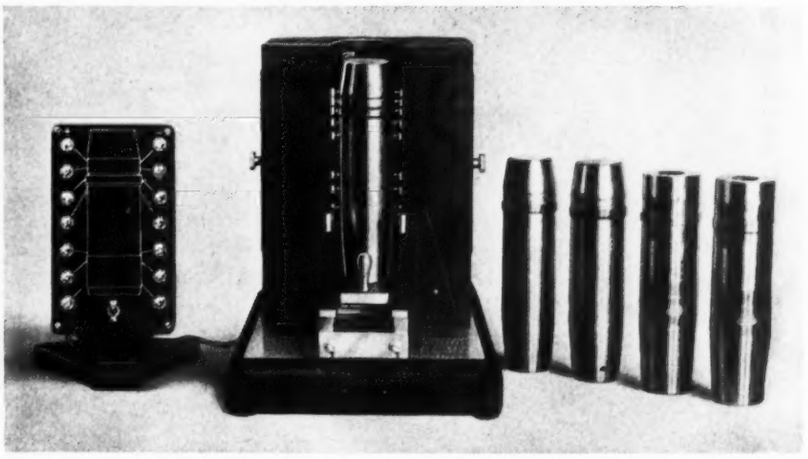


Fig. 1. Pratt & Whitney Multiple Electric Contact Gage with Masters for Setting Gage to Correct Limits for Checking Seven Dimensions

Pratt & Whitney Multiple Electric Contact Inspection Gages

Rapid and accurate checking of several dimensions simultaneously can be accomplished by the use of multiple electric contact gages developed by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. By simply observing pairs of red and green lights on a signal box, the inspector can tell instantly and in one operation if any section of a part gaged is too small, too large, or within the specified limits. Each gage is designed for a particular job, the electric contact principle being adaptable to a large variety of work.

The gaging of shells is one of the outstanding applications of the electric contact principle. It employs the signal box, the gaging fixture, and the masters shown in Fig. 1. This illustration shows the gaging fixture, which is composed of a base with positioning slide or ways and a vertical column to which are attached adjustable gaging sections.

The signal box shown at the left has a diagram of the work positioned between two rows of signal lights. When no shell is in the gage, both rows of lights are on. When a shell is placed in the gage, all the signal lights go out, provided all dimensions are within the specified limits. This provides a constant check on the signal lamps. Red lights at the left of the diagram on the signal box indicate over-size dimensions, and green lights at the right indicate under-size dimensions. Should a red light, for example, remain on when the shell is in the gage, the operator knows instantly that the shell is over size on the particular dimension indicated on the diagram by a line from the light to the diagram.

In most cases, the gaging sections are supported independently by parallel flat springs. As the shell is slid into the gaging position, each of the floating sections automatically aligns itself, producing an accurate diameter check, regardless of possible eccentricity between the several dimensions. Each gaging section has a fixed anvil and a movable spindle which actuates the contact arm. The light contacts are readily adjustable, so that the diameter tolerance can be quickly and easily set. Maximum and minimum masters are furnished with the gage for setting purposes. These master gages are made in sections to facilitate manufacture, but are the equivalent of solid masters when assembled.

A ten-station multiple electric contact gage for checking the angle and position of airplane propeller hubs is another important applica-

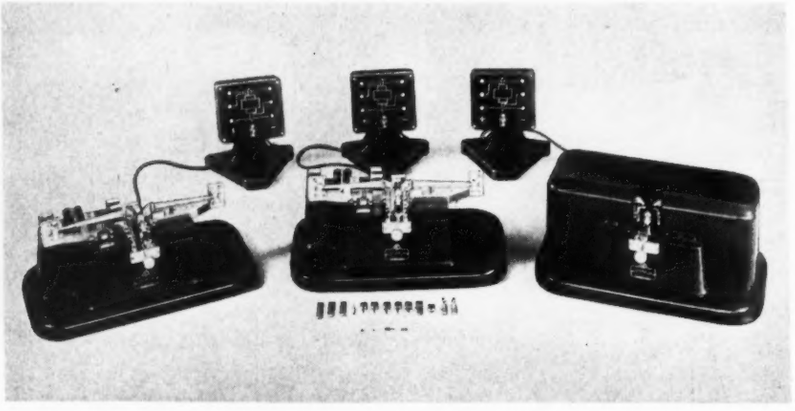


Fig. 2. Three Electric Contact Gages Used for Checking Time-fuse Pinions

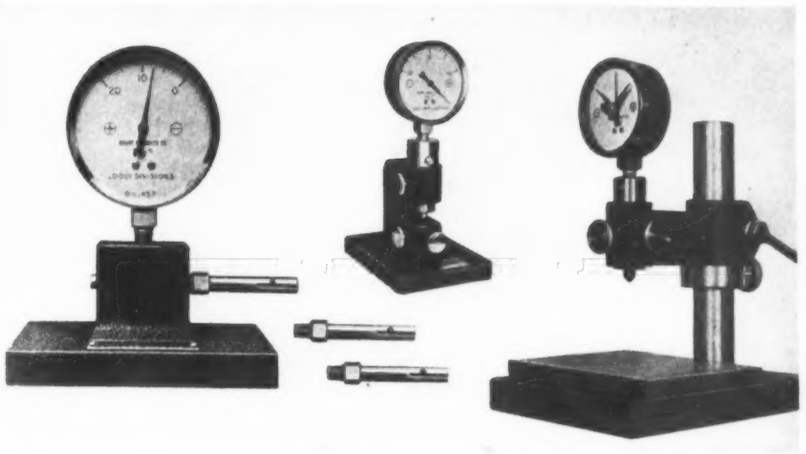
To obtain additional information on equipment described on this page, see lower part of page 156.

tion of the multiple electric gage. It performs a difficult inspection rapidly and accurately. Time-fuse pinions are also checked on three dimensions by gages of this type arranged as shown in Fig. 2. Two diameters and one length measurement are checked with this equipment. Automotive and airplane engine industries employ gages of this type for the inspection of ring grooves and land diameters of pistons. 90

Moore Pneumatic Comparator Gages

A pneumatic comparator gaging method has been developed by the Moore Products Co., 3629 N. Lawrence St., Philadelphia, Pa., for accurately amplifying small dimensional differences and instantly showing them on a dial type indicator. This method is particularly suited to production gaging, since the "wear" factor is eliminated and the operator does not require the sense of feel. The measuring points, which are actually air nozzles, do not touch the piece being gaged and, accordingly, are not subject to wear. Externally adjustable limit pointers are provided when speed of inspection is important.

In operation, a restricted amount of air from a filtered and regulated source of supply is admitted to the dial gage and measuring nozzle. Variations in the size of the work change the clearance space between the nozzle and the surface of the work. This permits more or less air to escape from the nozzle which, in turn, changes the pressure and indicates the variations in dimensions in decimals of an inch on the dial. The pressure-regulating equipment insures uninterrupted performance, regardless of wide fluctuations in the main air supply line. The presence of heavy grease or loose dirt on the piece has no effect on the readings, since the high pressure air instantly cleans the surface.

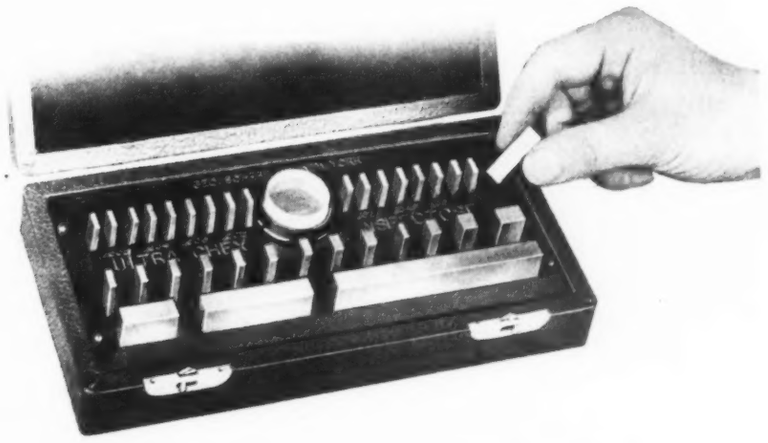


Three Types of Pneumatic Comparator Gages Brought out by the Moore Products Co.

Internal-bore gaging, especially for small holes in long tubes, which has heretofore been difficult and expensive, can be performed quite easily with the pneumatic gage. With this method, the plug serves merely as a guide, the measuring nozzles being recessed below the surface. The plug itself is provided with ample clearance over the minimum tolerance, and accordingly, fits quite loosely in the bore. The two nozzles are located diametrically opposite each other to insure measuring the true diameter and to compensate for the side motion of the plug. A 90-degree rotation measures out-of-roundness, and a lengthwise motion measures taper and bell-mouthed conditions. Standard ring gages representing the tolerance limits are slipped on the plug at regular intervals for comparison.

The amount of magnification can be made to suit the tolerance measurements, 0.001 inch being indicated by a pointer movement of 2 or more inches. Accurate dimensions are also read within less than 1/32 inch of the edge of the work-piece. With external gaging, a single nozzle is employed to make the measurements from a hardened and ground surface plate. The range of adjustments for various sized parts and depths of throat are made to suit the specific requirements.

When it is desired to record the actual measurement, a circular-chart recording meter is used instead of the indicating dial. This is particularly advantageous in taking long bore measurements in work such as gun tubes, recoil cylinders, etc., where measurements are made for each inch of length and where the inspection department desires to keep a permanent record. 91



"Ultra-Chex Inspectroset" Gage-blocks and Optical Flat

"Ultra-Chex Inspectroset" Gage-Blocks

The George Scherr Co., 128 Lafayette St., New York City, has added to its line of precision length standards the "Ultra-Chex Inspectroset" shown in the accompanying illustration, which consists of thirty-four gage-blocks. These gage-blocks will make up about 80,000 combinations in steps of 0.0001 inch from 0.300 inch to 8 inches.

An optical flat which is used for checking gage-blocks, micrometer anvils, and other lapped surfaces for parallelism and flatness is also furnished with the set. 92

To obtain additional information on equipment described on this page, see lower part of page 156.

Landis High-Speed Threading Machine

The Landis Machine Co., Waynesboro, Pa., has brought out a new high-speed hand-operated threading machine embodying features developed to promote the rapid and economical production of precision threads such as are required in the automotive and aircraft industries.

High-speed Threading Machine Built by Landis Machine Co.

With this 3/8-inch high-speed threading machine, the operations incident to threading all types of screws, studs, rods, etc., are controlled by one lever, which gives the operator complete freedom of one hand for loading and unloading the work. In operation, the grips are opened at the extreme end of the return stroke of the operating lever, and are automatically closed during the first portion of the forward stroke. The advance of the carriage is then controlled by the continuation of the forward stroke until the end of the thread is reached, after which the die-head is opened by an automatic trip. The die-head is closed automatically during the return stroke of the carriage; thus the operator has the period from the instant that the grips close until the return of the carriage to dispose of a finished piece and select the next piece to be threaded. The operating mechanism is so designed that little effort is required to move the lever.

The gripping unit consists of a spring-loaded toggle mechanism, completely housed in the carriage. Interchangeable grips are used to hold work of different diameters within the capacity range. Means are provided for centralizing the grips with the axis of the spindle and die-head. The gripper units are designed to permit work to be loaded from the top of the grip, so that the carriage travel can be held to a minimum for any combination of length of thread and work. Thus the necessity of pushing the work-pieces into and through the hole of a collet is avoided.

The drive to the spindle is through a single V-belt, four-step sheaves providing spindle speeds of 270, 338, 520, and 845 R.P.M. A single lever facilitates belt adjustment for any one of the spindle speeds. The drive is completely enclosed in the column of the machine, but is readily accessible through a hinged door at the rear. 93

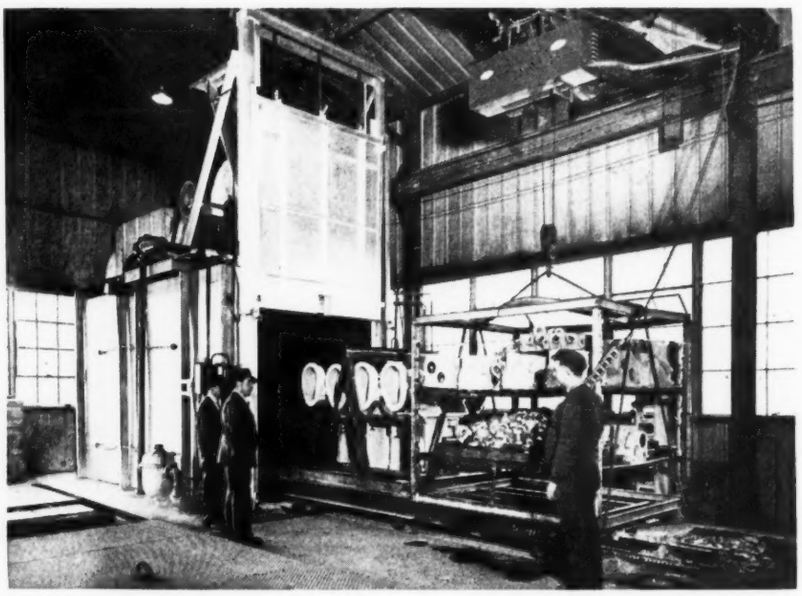
Despatch Heat-Treating Furnace for Aluminum and Magnesium Alloy Castings

A heat-treating furnace designed to facilitate rapid installation has been brought out by the Despatch Oven Co., Minneapolis, Minn. This furnace is of the radiant-tube, indirect gas-heated, convected-air type. It is adapted for heat-treating aluminum and magnesium alloy castings of various kinds, including aluminum alloy castings for aircraft engine blocks, tank rear-axle and transmission cases, aircraft engine oil-pans, turbine wheels, fans, manifolds, bomb turret casings and Diesel engine frames.

The particular furnace illustrated is used for the solution and precipitation heat-treatment of aluminum and magnesium alloy castings and parts. The net load capacity is 10,000 pounds of aluminum castings per charge, with a gross load rating of 14,500 pounds per charge. The furnace working chamber measures 7 feet wide by 8 feet high by 15 feet long.

The indirect gas-heating system provides a maximum temperature of 1000 degrees F. A fan with a capacity of 17,000 cubic feet per minute forces air around the radiant tubes and into the heat-distributing ducts. No combustion gases enter the furnace working chamber. The furnace is constructed of especially designed panels instead of the customary refractory or insulating brick. The interior wall panel is of 18-8 alloy steel, while the exterior panel is of heavy 16-gage steel. Between the walls there are 8 inches of high-grade insulation for keeping heat losses at a minimum. Full safety and temperature control systems, motorized door lift, loading car, and gear rack and drive system for rapid loading are supplied.

Although employed for the heat-treating of aluminum alloy castings, this furnace is also suitable for the tempering and drawing of alloy steels, normalizing, and stress-relieving of castings and welded sections, and other heat-treating processes requiring temperatures up to 1200 degrees F. 94

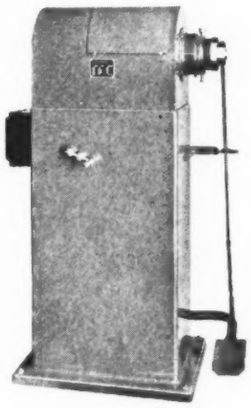


Despatch Radiant-tube, Indirect Gas-heated, Convected-air Type Heat-treating Furnace for Aluminum Castings

To obtain additional information on equipment described on this page, see lower part of page 156.

Schauer Lapping and Polishing Lathe

A new low-speed, high-power, variable-speed lathe known as the "Vaie" has been developed by the Schauer Machine Co., 2060-70 Reading Road, Cincinnati, Ohio, for use in producing small metal and plastic parts requiring accurate lapping or polishing. Speeds as low as 20 R.P.M., with ample power for heavy work at speeds up to 4000 R.P.M., are obtainable. These speeds are in a ratio of 5 1/2 to 1, based on the lowest speed desired when using a single-speed motor, or 11 to 1 when employing a two-speed motor.



Schauer Lapping and Polishing Machine

The motor is spring-mounted in the base, so that it automatically controls the tension of the driving belt. An automatic brake is applied on the spindle when the foot-treadle is depressed to open the motor circuit. The spindle is equipped with a three- or four-jaw chuck or special holding fixtures to suit individual requirements. All parts are easily accessible, the motor and drive being available for adjustment by simply removing a panel at the rear of the machine base. 95

Seneca Falls Star Lathe Equipped for Army Service Trucks

The Seneca Falls Machine Co., Seneca Falls, N. Y., has brought out its standard removable-gap, 14-inch, Star engine lathe equipped with special legs and motor drive unit for use in United States Army service trucks. This lathe is designed to provide a light-weight machine capable of handling work with large-diameter flanges and repair jobs on rifles, guns, tanks, and motor truck parts which can be repaired right on the field.

The lathe driving motor is mounted on a bracket attached to the head leg, which also supports a swinging member for carrying the auxiliary cone. The swinging member can be set in two positions by means of a lever which operates a toggle joint. When this lever is pushed backward, the belt is tightened on the two cones. In the forward position, the belt is loose and the operator can revolve the spindle and faceplate by hand with little effort.

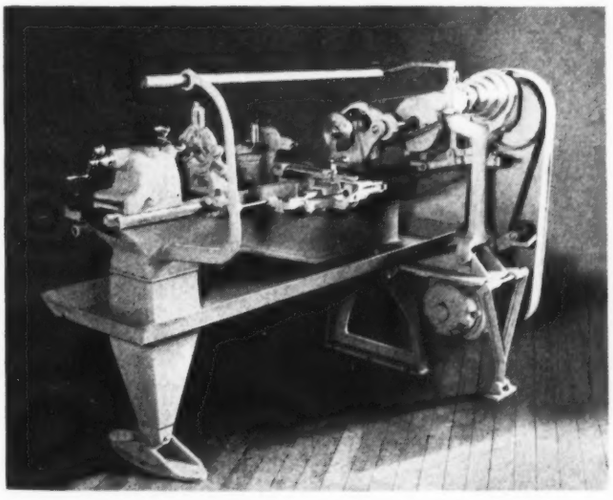
The taper turning attachment is secured to the back of the carriage, travels with it, and is always in position ready for use; it is available the full length of the bed. The swivel guide bar is graduated in degrees and inches to facilitate quick and accurate settings.

The special tailstock leg is designed on the universal joint principle, so that the unavoidable twisting and weaving of the truck platform cannot distort the lathe bed or throw the lathe out of proper alignment. The weight, including the motor drive unit, but not the motor or equipment, is 1700 pounds. 96

Dayton Rogers Heavy-Duty Die Cushions

A heavy-duty, multiple-mounting, Model 2C pneumatic die cushion is being placed on the market by the Dayton Rogers Mfg. Co., 2830 Thirteenth Ave. S., Minneapolis, Minn. These new die cushions are self-contained, carrying their own surge tanks, and are made in sizes up to and including 24 inches. They can be furnished in multiples of two, four, or six, having maximum ring-holding pressures up to and including 90 tons, with a capacity for deep-drawing shells up to and including 10 inches.

These cushions can be used for controlling the pressure pads and for all forming operations. Each cushion installation is supplied with a combination regulating reducing valve and pressure gage to retain the correct draw-ring holding pressure and pressure-pad control throughout the work cycle on a given job.



Seneca Falls Star Lathe Equipped with Special Legs and Drive for Army Service Trucks

Heavy-duty Die Cushion Placed on the Market by the Dayton Rogers Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 156.

Fig. 1. Brown & Sharpe End-Mill Sharpening Attachment

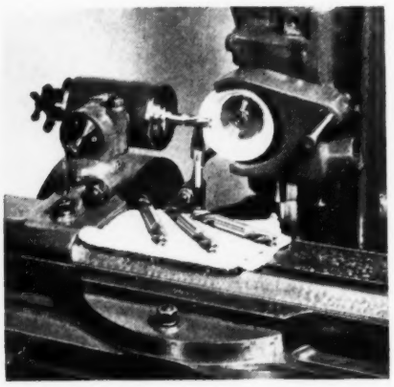


Fig. 2. Attachment Set up for Sharpening Double-end End-Mills

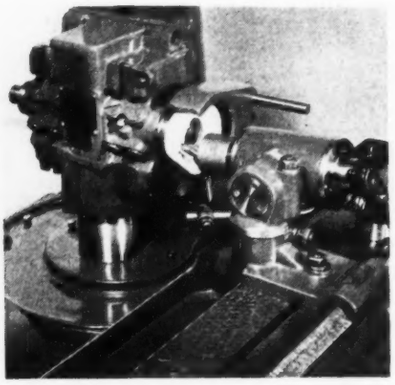


Fig. 3. Sharpening End Teeth of Right-hand Spiral End-Mill

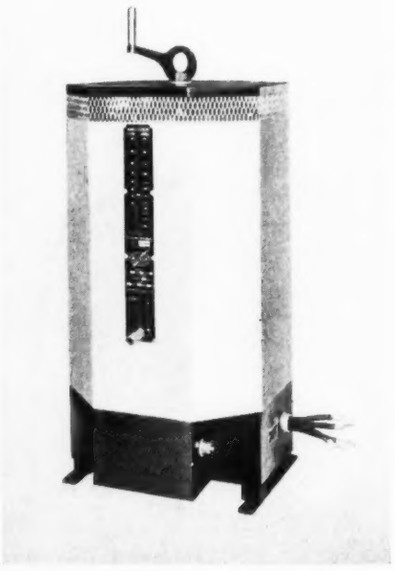
The working pressure in pounds per square inch is recorded at all times on the pressure gage furnished with each installation. The model shown in the illustration is particularly suitable for use on large straight-side presses for drawing and forming such parts as table tops, stove tops, refrigerator sections, and automobile body doors. 97

Wilson Transformer Arc Welders

A new line of alternating-current transformer welders in 300-, 500-, 750-, and 1000-ampere capacities has just been introduced to the trade by the Wilson Welder and Metals Co., Inc., 60 E. 42nd St., New York City. These welders, known as Model TW, are completely self-contained units, designed for heavy arc-welding needs of shipyards, railroads, and steel mills. They are built for operation on 220, 440, or 550 volts, 25- or 60-cycle current. When arranged for 220- and 440-volt operation, single phase, either voltage can be brought into use by a reconnection of the leads, which are brought outside the unit.

The new welders have a wide range of current output, and continuous stepless current regulation is provided over the entire range by means of a hand-crank on top of the machine. This crank makes it possible to shift the setting rapidly as changes are made from one class of work to another.

The divided construction of the coils used on this welder allows a larger surface area to be exposed to the cooling air, and therefore permits cooler operation. The coil covering is heat-resistant, spun-glass fiber, Class B insulation, developed to permit continuous operation at maximum settings. 98



Wilson Model TW Arc Welder

Brown & Sharpe End-Mill Sharpening Attachments

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently redesigned the No. 10 and No. 13 B & S end-mill grinding attachments illustrated and described in August, 1940, MACHINERY, page 139, and changed the names to No. 10 and No. 13 end-mill "sharpening" attachments.

As shown in the illustrations, the spindle of the No. 13 attachment is carried in a body that can be set at an angle in both the horizontal and vertical plane, rigid clamping being provided for both adjustments. Graduations to 2 degrees provide for angular settings 16 degrees either side of zero in the vertical plane, and 90 degrees either side of zero in the horizontal plane, the base itself being aligned by the inverted vee of the table top. Zero marks 180 degrees apart on the spindle body provide for sharpening both right- and left-hand cutters.

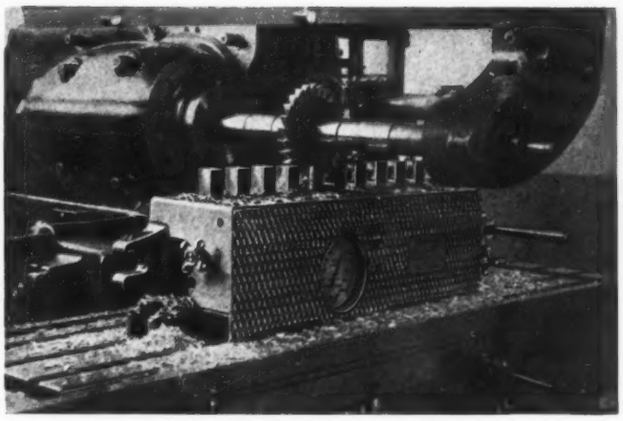
End-mills having a No. 9 B & S taper shank will fit directly into the attachment spindle, while cutters having shanks of other B & S tapers, as well as cutters with milling machine taper shanks and straight shanks, are accommodated by stock collets and adapters. A draw-in bolt can be furnished for use with spring collets for holding straight-shank end-mills.

This improved attachment is designed for sharpening both the peripheral and end teeth of end-mills. It is especially adapted for sharpening the peripheral teeth of steep spiral end-mills having straight or taper shanks. For the latter work, a knob at the rear end of the attachment spindle facilitates holding the tooth being ground in contact with the tooth-rest while feeding the cutter across the wheel by longitudinal table movement. Anti-friction spindle bearings provide a sensitive, free-turning unit that is an advantage when sharpening very small end-mills having a steep spiral. 99

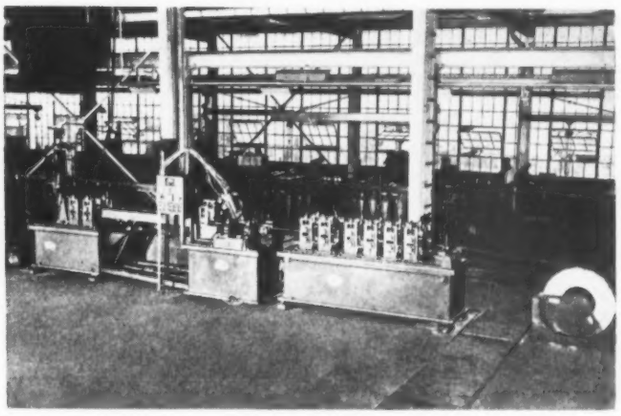
"Hydra-Grip" Fixture for Gang Chucking

A hydraulic work-holder known as "Hydra-Grip," designed for gang chucking operations, has been brought out by Hydra, Inc., 417 S. Hill St., Los Angeles, Calif. This attachment has interchangeable collets that hold ten pieces of work in accurate alignment for precision machining on milling machines, shapers, and grinding or drilling machines. After the work is dropped into the collets, a few strokes of the hydraulic pump bring the clamping pressure to any desired point up to 4000 pounds.

To obtain additional information on equipment described on this page, see lower part of page 156.



"Hydra-Grip" Fixture Designed for Equalized Hydraulic-pressure Gang Chucking



Tube-welding Machine Brought out by The Linde Air Products Co.

This attachment is designed to reduce loading and unloading time to a minimum. Alignment and height tolerances are held to standard specifications for precision work. Collets are available in a full range of sizes varying by steps of 1/32 inch from 1/4 inch to 1 1/4 inches for holding round, square, or hexagonal stock.

Equalized hydraulic pressure holds all pieces uniformly, regardless of variations in size, within normal limits. Accurate control of the pressure makes this attachment particularly suitable for holding thin-walled or easily distorted work. The attachment is 29 inches long, 5 1/2 inches wide, 6 inches high, and weighs 125 pounds. 100

Hammond "OK" Grinders

Hammond Machinery Builders, Inc., 1619 Douglas Ave., Kalamazoo, Mich., have just introduced on the market three streamline "OK" grinders for tool and light snagging grinding. All moving parts, such as spindles and bearings, are of oversize construction. The bases of the machines are of heavy cast iron, with straight vertical lines unbroken by protruding parts which might interfere with grinding operations.

The heavy-duty motor is mounted at the top of the base. The three machines accommodate wheels 10, 12, and 14 inches in diameter, and are equipped with 1-, 2- or 3-H.P., 220- or 440-volt, three-phase, 60-cycle, alternating-current, 1750-R.P.M. motors.

Standard equipment includes the heavy-duty motor; push-button starter with overload protection; exhaust type guards; adjustable spark deflectors; tool tray; and adjustable tool-rests. 101

Oxy-Acetylene Tube-Welding Machine

Tubing of low-carbon, stainless, and other alloy-steel skelp can be continuously welded at high production speeds on a new automatic oxy-acetylene tube-welding machine brought out by The Linde Air Products Co., Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York City. The new machine has been developed to produce high-quality continuously welded stainless-steel tubing at low production cost. It can be employed to produce tubing from unpickled, hot-rolled stock, such as is required for automotive exhaust tubing, conduit tubing, and structural tubing on which a smooth polished finish is not necessary.

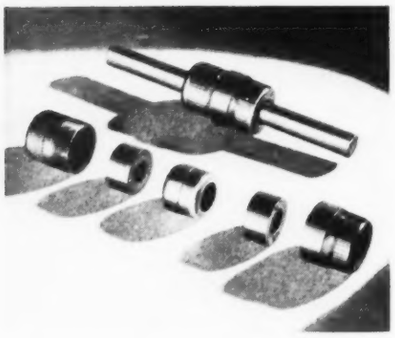
It is claimed that 18-gage material can be welded on this machine at speeds up to 150 feet per minute, and that heavier materials can be handled at comparable speeds. The forming mill section of the new tube-welding machine is similar in construction to that of previous tube-welding machines. The flat skelp is fed in from a coil through a series of forming stands driven through a worm-gear mechanism, which assures an even feeding action at exceptionally high speeds.

In addition to plain carbon, cold- and hot-rolled steels, and stainless steels, the new welding machine will handle a wide variety of alloy steels. It is estimated that one tube-welding machine can turn out over 12,000,000 feet of tubing per year. In operation, the flat steel skelp is fed into the machine, automatically formed into tubing, and oxy-acetylene-welded at high speed. The tubing is welded by a combination of intense heat from a multi-flame welding head and pressure exerted by four guide rolls. The oxygen and acetylene supply and the operation of the blow-pipe and driving motor are controlled at one central panel. The oxygen, acetylene, and cooling water supply lines and the electrically and pneumatically controlled valves are located at the rear of the control panel. After the tubing is welded, it passes through a water quench trough and then through a set of rollers which straighten the tubing before it is cut to length.

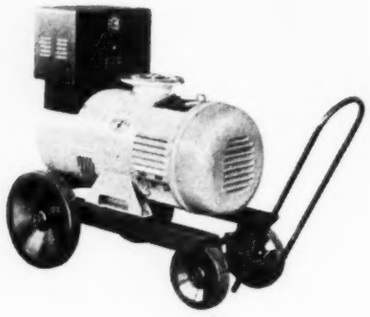
The welded tubing, cooled and straightened, is cut to the required lengths by means of an automatically operated shear. The slight weld reinforcement ridge is usually removed with a cutting tool placed in back of the welding flames. With this arrangement, the seam can hardly be detected. 102

Hammond "OK" Grinder Built in Three Sizes

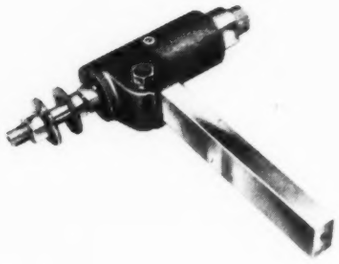
To obtain additional information on equipment described on this page, see lower part of page 156.



Flexible Coupling Made by the Harris Products Co.



Arc Welder Equipped with "Stroco" Crater Eliminator



Toolpost Grinding Attachment Made by Stow Mfg. Co.

Harris Flexible Drive Shaft Couplings

Low first cost, low maintenance cost, fast assembly, accurate balance, and smooth exterior are features claimed for a new line of flexible drive shaft couplings brought out by the Harris Products Co., 5424 Commonwealth Ave., Detroit, Mich. Each type of coupling is so designed that it can be used with a different size of shafting at each end. High "wind up" is a feature of the coupling which permits either parallel or angular misalignment. Any size shafting between 1/4 inch and 1 3/4 inches in diameter, inclusive, can be handled by one of the six types of reversible couplings which comprise the new line. Torque capacities range up to 825 inch-pounds. 103

Wilson Crater Eliminator for Arc Welding

The Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York City, has just placed on the market an electric arc crater eliminator, known as the "Stroco," for use where the presence of the typical crater at the end of a weld deposit is objectionable. This auxiliary device is mounted on the body of the arc-welding generator, as shown in the illustration, and is connected in series with the excitation field of the generator and controlled by a switch which enables the operator to cut it in or out of the excitation field service at will.

This eliminator, when introduced into the circuit, makes it possible to accomplish a tapering off or a fading of the current instead of an abrupt change. The weld deposit made under these conditions is free from porosity at the end, and has a smooth, even contour.

The crater eliminator is controlled by a three-position button switch located on the electrode-holder. Under ordinary welding conditions, the switch is in the neutral position and the eliminator is entirely inoperative. When the operator is about to break the arc, either because he is approaching the end of one electrode or because he is approaching the end of a weld, he presses the button backward into the "on" position of the switch housing. This brings the crater eliminator into operation and causes the arc to fade out gradually until the arc voltage becomes so low that it can no longer deposit metal. 104

Ingersoll-Rand Air-Operated Wrenches

The Ingersoll-Rand Co., 11 Broadway, New York City, has developed an air-operated, impact wrench, Fig. 1, designated Size 504, which weighs only 4 pounds, is reversible, and can handle up to and including 3/8-inch bolt size nuts. The design embodies the patented Pott impact wrench principle which localizes the steel-to-steel impact without transmitting shock to other parts of the tool. The pistol-grip handle, short over-all length, and small nose diameter of the tool permit operation in close places. The average working speed at an air pressure of 90 pounds per square inch is 1050 R.P.M.

Another improved air-operated impact wrench, Fig. 2, of similar design, for use in applying and removing nuts up to 1 1/4-inch bolt size, has been developed by the company. This wrench (Size 534) also is suitable for operation in close quarters.

This tool is adapted for use in shipyards, oil refineries, chemical plants, steel construction, and general repair shops. The working speed at 90 pounds per square inch air pressure is 635 R.P.M. The weight is 27 1/4 pounds. 105

Stow Toolpost Grinding Attachment

A new toolpost attachment for lathes that is driven by a portable flexible-shaft machine is being made by the Stow Mfg. Co., Inc., Binghamton, N. Y. By means of this attachment, a lathe can be adapted to a wide range of both internal and external grinding operations. The device accommodates grinding wheels up to 6 inches in diameter with a face width of 1 inch. The clamp spindle can be removed and a Stow collet chuck substituted that will accommodate a variety of mounted wheels and points for use in internal grinding and recess surfacing at speeds up to 6800 R.P.M.

A combination radial thrust and annular ball bearing is used on the tool end of the toolpost attachment, and a floating self-aligning ball bearing on the shaft end. 106

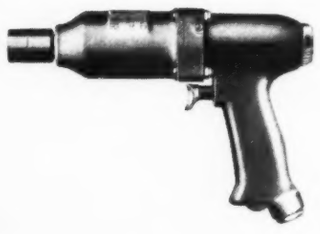


Fig. 1. Ingersoll-Rand Light-weight, Air-operated, Impact Wrench

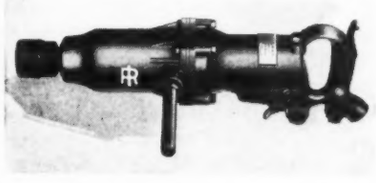
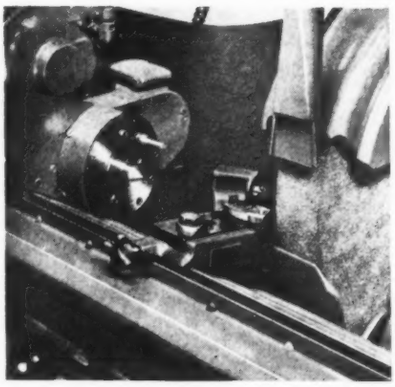


Fig. 2. Another New Ingersoll-Rand Impact Wrench, of Larger Size

To obtain additional information on equipment described on this page, see lower part of page 156.



B&S Radius-truing Attachment Applied to No. 5 Plain Grinding Machine

Radius Wheel-Truing Attachments

Three new attachments which provide ready means of forming wheels for grinding to shoulders where a fillet is required, and which permit shaping either the right- or left-hand corner of the grinding wheel to any convex radius up to 1/2 inch, have been brought out by the Brown & Sharpe Mfg. Co., Providence, R. I. These attachments are designed for use on the No. 5, Nos. 10 and 12, and Nos. 20, 22, and 23 B & S plain grinding machines.

The base of the attachment is secured to the machine table by a clamp which is operated by a knob at the outer end of the attachment for the No. 5 machine, shown in the accompanying illustration, and by a lever on the other sizes. The hand-operated diamond-tool holder is supported and guided by a fixed segment-shaped piece, and the segment, in turn, is mounted on a slide which is adjustable transversely when the attachment base is clamped in position by a screw. This transverse adjustment permits shaping the grinding wheel without changing its position when the machine is set up for grinding work of any diameter.

Figures stamped on the back face of the diamond-tool holder show the exact radial distance from this surface to the center of the segment-shaped guide when the holder is in the operating position; consequently, by using a micrometer or gage, the diamond tool is readily adjusted to give the desired radius.

Each attachment includes a diamond-tool blank, a mounted diamond being furnished as extra equipment. The attachment for the No. 5 machine weighs 2 pounds; for the Nos. 10 and 12 machines, 8 pounds; and for the Nos. 20, 22, and 23 machines, 11 pounds. 107

Ransome Welding Positioner

An improved heavy-duty welding positioner with a capacity for handling work up to 3000 pounds in weight has been brought out recently by the Industrial Division of the Ransome Concrete Machinery Co., Dunellen, N. J. This company's line of welding positioners now covers a range of capacities from 2500 pounds for the hand-operated type up to 8 tons for the heavy-duty motor-operated type.

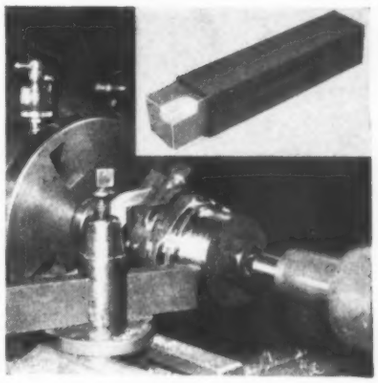
The new positioner has a machined-steel table top 40 inches square provided with four radial and four longitudinal T-slots for 3/4-inch bolts. This arrangement has been developed to facilitate the set-up of pieces to be welded. The all-welded construction of the unit assures safe operation when working under full-load conditions. A 3000-pound lathe with a center of gravity 12 inches above the table and 12 inches from the center of the table can be carried. A motor is provided for tilting the table from the horizontal to 45 degrees beyond the vertical. The table top can be rotated at constant or variable speed as desired. Remote-control push-buttons are provided for the convenience of the operator. 108

Improved Kennametal Steel-Cutting Tools

Improvements in the various grades of steel-cutting Kennametal tool carbides to provide both greater hardness and greater strength have been made by McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa. The new hardness and strength values for the four standard grades of Kennametal cover a range of Rockwell hardness from 77.6 to 80.6; transverse rupture strengths from 225,000 to 350,000 pounds per square inch; and thermal conductivity values from 0.068 to 0.113.

Kennametal Grade KM is used on 90 per cent of the steel-cutting jobs in lathe and boring tools for machining alloy-steel and carbon-steel forgings, castings, and bar stock— for both continuous and interrupted cuts. This grade is exceptionally strong, and can be used for shaping hard armor plate, as well as for interrupted turning and facing cuts on work such as shown in the illustration. This grade is widely used in shell-turning tools, where it is especially adapted for cutting-off and base-facing tools.

Kennametal Grades KH and K3H

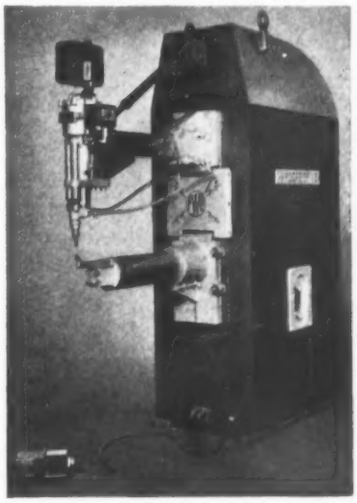


Style No. 3 Kennametal Tool Turning Square Tool-steel Washers

are used on light finishing cuts or for very soft steel, such as S A E 1010, 1020, or free-machining steels. Grade K4H is extremely hard, and is used for the precision-boring of steel with light cuts. 109

Progressive Deep-Throat Welder for Spot-Welding Tanks

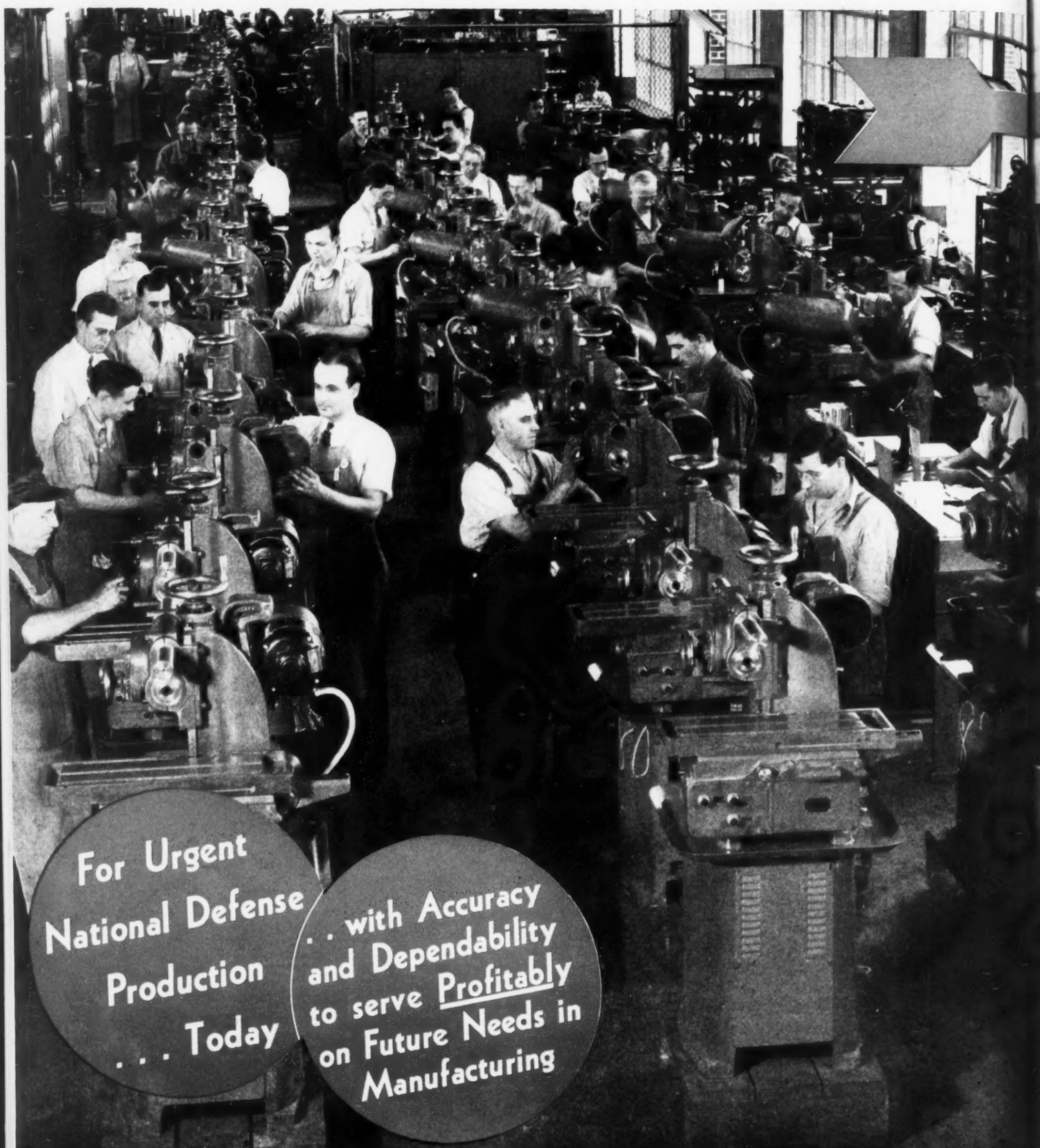
To facilitate resistance spot-welding inside of deep assemblies, such as tanks of various types, barrels, etc., the Progressive Welder Co., 3100 E. Outer Drive, Detroit, Mich., has brought out a variation of its pedestal type welder. The lower arm of the new welder is built of heavy tubing and fitted with a receptacle adapter for the lower electrode. This construction makes it unnecessary to support the lower arm by the usual braces. Elimination of these braces, in turn, makes it possible to slide deep assemblies over the arm



Deep-throat Welder Built by the Progressive Welder Co.

To obtain additional information on equipment described on this page, see lower part of page 156.

– MORE Nº 000s



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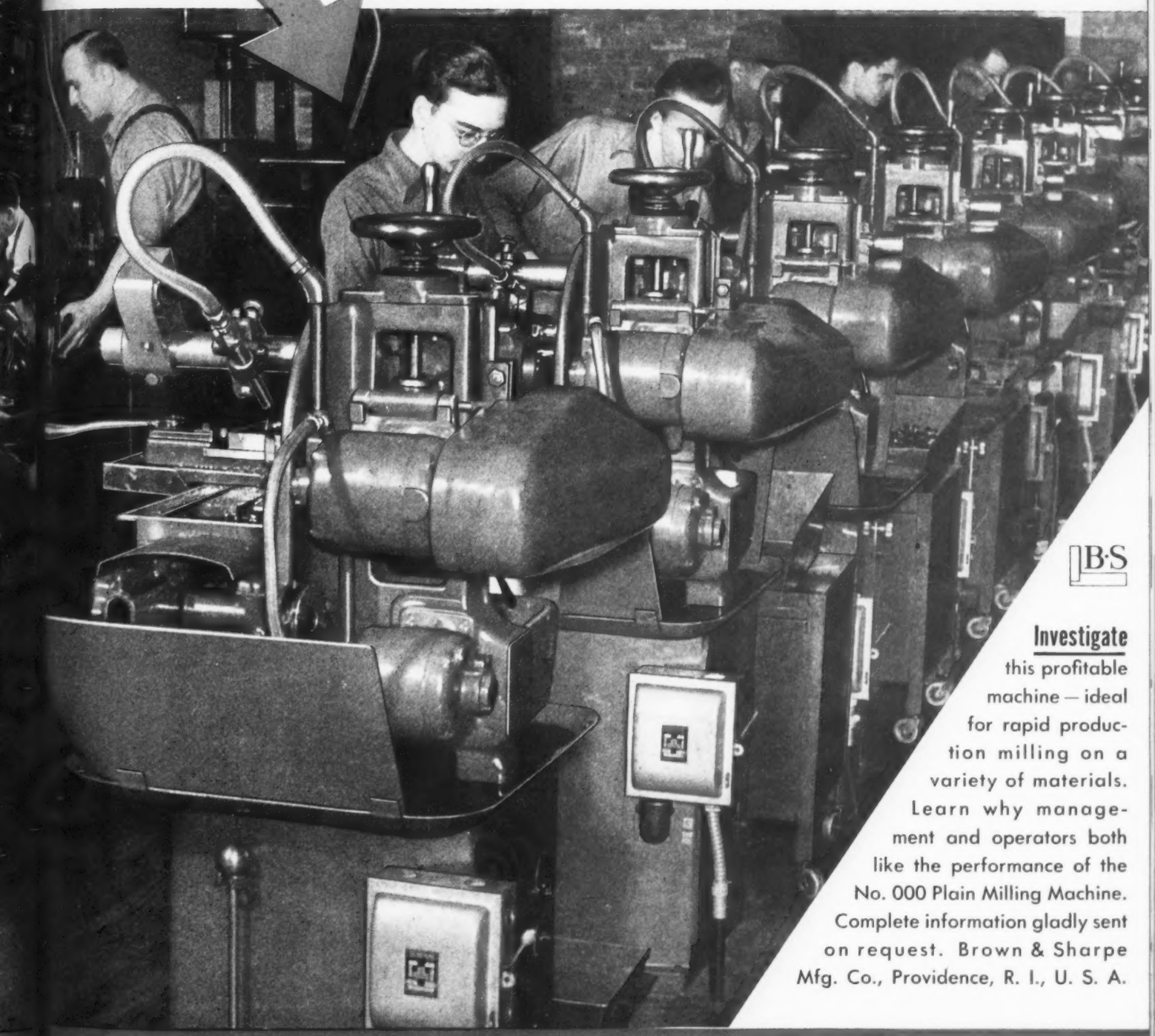


B·S

Investigate this profitable machine — ideal for rapid production milling on a variety of materials. Learn why management and operators both like the performance of the No. 000 Plain Milling Machine. Complete information gladly sent on request. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

SHARPE

to the full throat depth. The upper arm, carrying the upper electrode and gun assembly, is braced in the conventional manner. Both upper and lower arms are so designed that they can be adjusted in or out to increase or decrease the throat depth as required to suit different sizes of work.

In welding a part such as a cylindrical tank, the unit is slipped over the lower arm to the correct position for welding, the unit resting on the lower electrode. Pressing the control actuates the hydraulic welding gun and brings the upper electrode down against the part to be welded, initiating the weld cycle. These welders are provided in standard capacities of 75 and 150 kilovolt-amperes. Other capacities are available on special order. 110

Vernon Rotary Table

To meet the demand for a compact and versatile rotary table, the Machinery Mfg. Co., 1915 E. 51st St., Vernon, Los Angeles, Calif., is placing the new Vernon 7-inch rotary table into quantity production. This unit has a low table level of only 2 3/4 inches and affords maximum working space. Each of the four quadrants of the table is graduated from 0 to 90 degrees, and its friction-loaded worm dial is calibrated into 240 minutes to insure quick and easy setting.

The table movement is registered against an adjustable point. The worm-gear is hobbed integral with the table, and the worm can be readily disengaged to permit free rotation of the table. Positive setting is assured by a quick-setting thumb-screw type locking device. The entire unit is designed for heavy-duty use, and the table is ribbed to prevent distortion. Both the table and base are ground on the top and bottom. 111

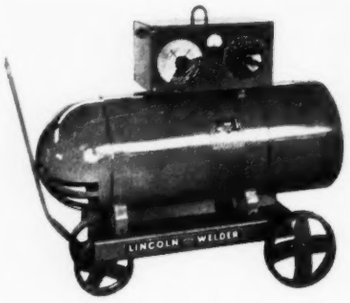


Fig. 1. Lincoln Arc-welder Control Box Mounted on 300-ampere Welder

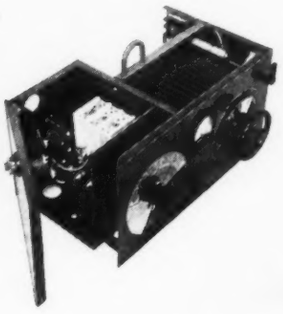


Fig. 2. Lincoln Welder Control Box Open to Show Arrangement of Parts

Lincoln Improved Arc-Welder Control Box

Improvements in dual continuous control for arc-welding machines are provided in the form of a new welder control box recently brought out by the Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio. This control box, known as Type G, is designed to prevent accidental contact with live parts, increase accessibility, permit wiring with flexible or rigid conduit, or rubber-covered multiple conductor cable, and eliminate dangers from unintentional loosening of the lifting hook.

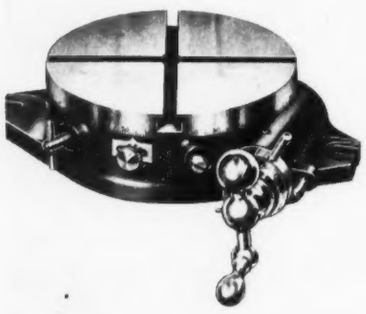
An important feature of the new box, shown mounted on a 300-ampere portable welder in Fig. 1, is the separate compartments for all alternating-current circuits and for the direct-current terminals, as shown in Fig. 2. Both compartments have a snap catch which holds the door in the closed position. The control box is permanently grounded to the motor and generator frames to meet the requirements of special inspection rules. 112

Pacific Knurling Tool

A new type knurling tool known as the "Handy Knurler" is being placed on the market by the Pacific Specialty Supply Co., 344 N. Vermont Ave., Los Angeles, Calif. This knurling tool, shown in Fig. 1, has three knurls, and is held by hand like a pair of pliers. It has a capacity for knurling work from 5/16 inch to 2 inches in diameter. The work to be knurled can be held in a lathe chuck, drill press, or even in a vise. All that is necessary in applying this tool is to bring the knurls into contact with the work and compress the handles in the manner shown in Fig. 2. 113

FerroFilters for Removing Iron Particles from Lubricants and Coolants

The S. G. Frantz Co., Inc., 161 Grand St., New York City, has recently added two new FerroFilters to its line of permanent-magnet equipment for keeping lubricating oil and coolant systems free from fine iron particles. These filters are similar in design to the one described on page 169 of December, 1940, MACHINERY, one being of larger capacity and the other of smaller capacity than previous models. This line of Series PQ permanent-magnet filters now includes

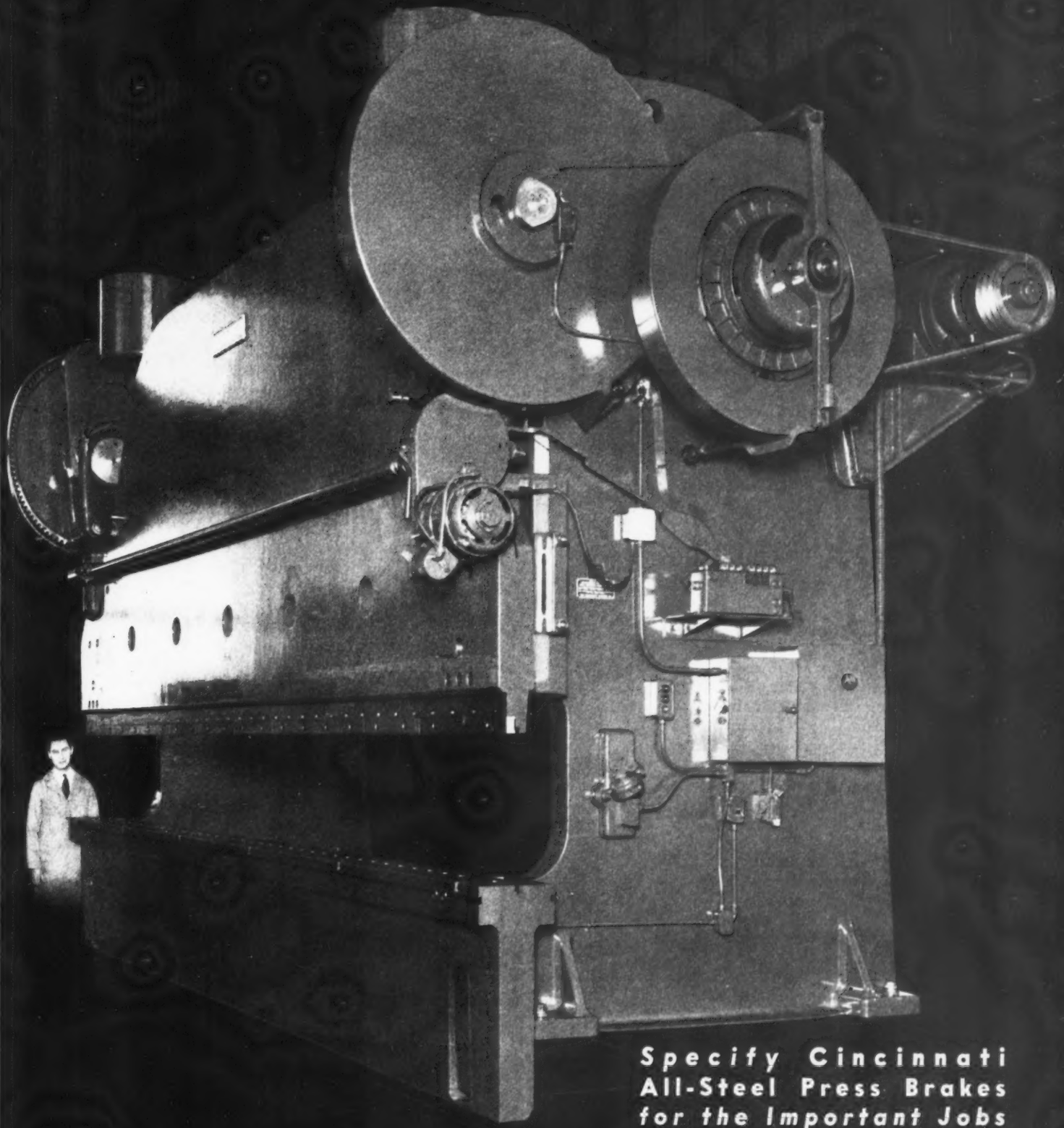


Vernon Rotary Table Made by the Machinery Mfg. Co.

Fig. 1. Pacific Knurling Tool and Examples of Work

Fig. 2. Method of Employing Tool Shown in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 156.



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18' 6" between housings
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Where accuracy of work produced is the prime consideration—be it bending, corrugating, multiple punching or a combination of operations—our 20 years of experience in building press brakes is a very good reason why you should specify "Cincinnati."

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Frantz Permanent-magnet FerroFilter

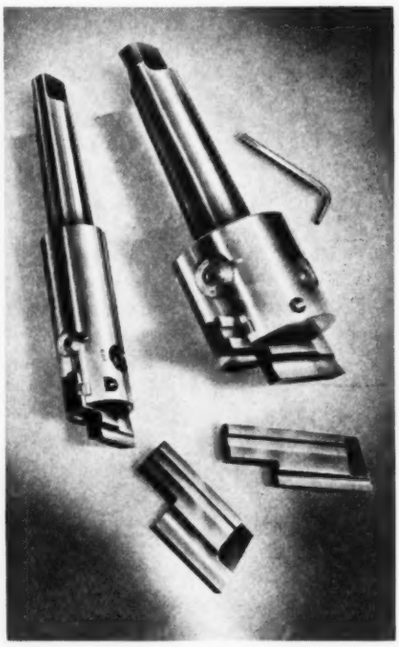
five sizes for pipe line connections from 3/8 inch to 2 inches.

These filters are now performing an important function in gun boring and drilling operations by reducing wear and resulting leakage of the high-pressure pumps employed to force the coolant to the cutters through the hollow boring and drilling bars. Pumps used for this work, which operate at pressures of from 750 to 1500 pounds per square inch, had previously given trouble from wear resulting from the very fine steel chips which fail to settle out of the coolant, but which can now be readily removed by the Ferro-Filters. 114

B & B Spot-Facer and Boring Tool

The Bokum Tool Co., 49 W. Hancock Ave., Detroit, Mich., has brought out a B & B spot-facer and boring tool designed to perform a wide variety of operations and to eliminate many extra tools required for certain jobs. It will bore to exact diameters and face hole bottoms square and flat. The tool consists of a head or bar with a cutter-blade running through a crosswise slot at its outer end. A dial with micrometer readings, which enables the operator to set and lock the blade securely to diameter measurements within 0.0001 inch, is located on the head.

The tool is made in three models, the standard blades providing a range of boring diameters up to 22 inches. A wide range of spot-facing is also provided for. With the aid of a standard small tool adapter, the same tool can be used to bore holes as small as 1/4 inch in diameter. By using blades with step formation, many different diameters can be bored, and steps or shoulders can be faced at the same time. 115



Spot-facing and Boring Tools Made by the Bokum Tool Co.

Sweet's Catalog File for Mechanical Industries

In "Sweet's Catalog File for the Mechanical Industries," published by the F. W. Dodge Corporation, 119 W. 40th St., New York City, which will be distributed during September without charge to 7000 iron and steel fabricating plants, machinery manufacturers, railroad and transportation equipment shops, government buyers, etc., there is included, this year, a machine tool division in which twenty leading machine tool builders have specially prepared catalogue sections. The object is to give users of machine tools instant access to comprehensive data to aid them in selecting their machine tool requirements. Reprints of the catalogue material are also available for use in correspondence and for presentation by sales representatives. The complete file comprises the catalogues of some 600 manufacturing concerns in the entire mechanical industries—a total of 1600 pages.

The cross-indexing enables the user to locate buying information quickly by looking up either the name of a product, its trade name, or the name of the manufacturer who makes it.

* * *

Motion Picture Available to Industrial Groups

The Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh, Pa., has made available for use by clubs, engineering societies, shop groups, and civic organizations, a 16-millimeter 800-foot sound film entitled "There's a Job to be Done." This film deals with the place of stainless and special steels in the National Defense Program. It is a stirring, patriotic picture that should have great appeal at the present time. No charge is made for the use of the film, but the user must have his own sound projector.

* * *

The American Gear Manufacturers' Association announces that industrial gear sales for July were approximately the same as for June, and 111 per cent above those for July, 1940. The sales for the seven months ending July, 1941, were 123 per cent above the corresponding period of 1940. This applies to industrial gears only.

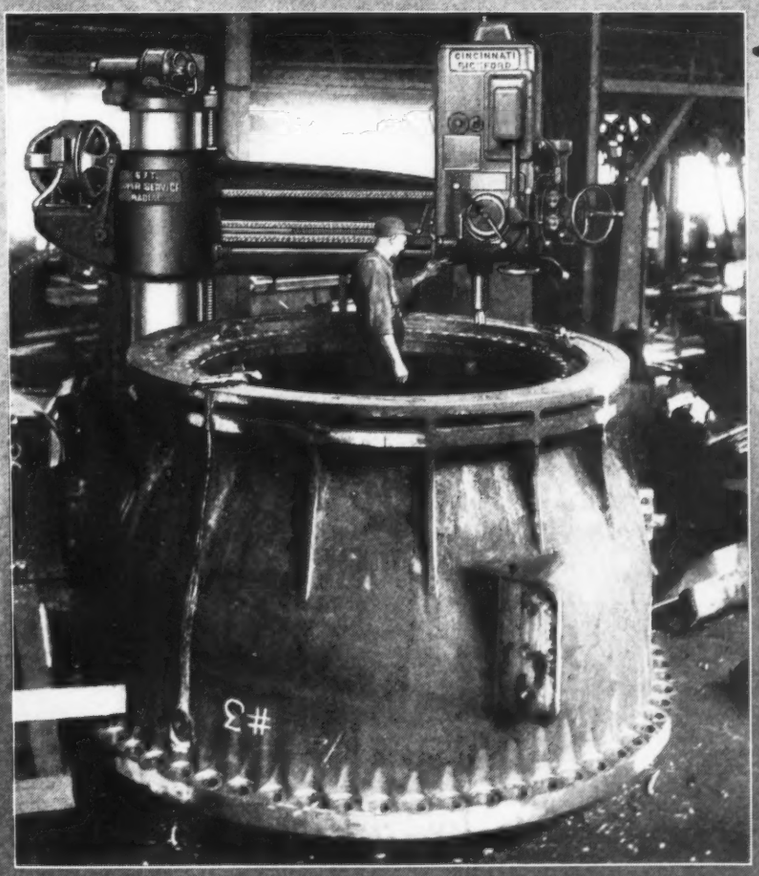
Century-Old Firm Still in Front Ranks

Sixteen huge lathes, among the largest ever constructed, are now being assembled in the Pittsburgh plant of the Mackintosh-Hemphill Co. These lathes have been ordered by the United States Navy and are to be used in making big guns. It is of interest to note that the building of big guns is a tradition of the Mackintosh-Hemphill Co., which is one of the oldest manufacturing concerns in the United States. It is mentioned that Perry won his victory on Lake Erie in 1812 with cannon and cannon balls from the Mackintosh-Hemphill plant; that in the Mexican War in 1846, Mackintosh-Hemphill guns were used; and that during the Civil War, this company produced the largest cannon the world had known up to that time. The company was also engaged in armament production in the Spanish-American and in the last World War.

To obtain additional information on equipment described on this page, see lower part of page 156.

The SUPER SERVICE *Radial*

SAVES TIME WITH CONVENIENT



60-ton Valve being drilled, tapped and spot-faced on a Super Service Radial at The Thomas Spacing Machine Company, Pittsburgh, Pa.

Low Controls at THE HEAD

Especially on large work like this, it is important to have centralized controls within easy reach of the operator in order to do a maximum amount of work in a minimum amount of time. Save time and speed up radial drilling production with a machine that has: controls for all speeds and feeds, column and arm clamping, arm elevation, and power rapid traverse, all within easy reach of the operator.

Send for Bulletin R-24 covering these machines.

SUPER SERVICE

THE CINCINNATI BICKFORD TOOL CO.

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Heat-Treatment of Molybdenum High-Speed Steel

The Office of Production Management, Washington, D. C., has issued the following statement, of interest to all users of molybdenum high-speed steel, which must now, to a considerable extent, be used in cases where tungsten high-speed steel was formerly employed. The statement reads as follows:

"Considerable demand has arisen for literature instructing metallurgists, heat-treaters, and users as to a method for treating molybdenum high-speed steel to produce its highest efficiency. Many statements are made that molybdenum high-speed steel is as efficient as tungsten high-speed steel, provided the former is properly treated to avoid decarburization and to bring out its best qualities. Because of the shortage of tungsten and instructions prohibiting the use of tungsten high-speed steel, when avoidable, it seems desirable to circulate the pertinent information. Committees of experts have been appointed on: (a) Heat-treating of molybdenum high-speed steels, consisting of Norman I. Stotz, chairman, W. H. Wills, F. Lloyd Woodside, J. H. McCadie, J. Edward Donnellan, secretary; (b) furnaces and controlled atmospheres, consisting of C. I. Hayes, chairman, P. B. Crocker, W. M. Hepburn, Norbert Koebel, Karl Ness, J. Edward Donnellan, secretary; and (c) salt baths, consisting of Artemus F. Holden, chairman, James McElgin, J. N. Bourg, W. J. Levy, J. Edward Donnellan, secretary.

"Preliminary and tentative reports have been prepared by these committees, which when passed by the committee members, will be circulated among experts, with the object of securing as much additional information on the subject as possible. Subsequently, final reports will be prepared by the committees, which will be printed and distributed to all interested persons. As soon as practicable, there will also be projected meetings of local chapters of the American Society for Metals, addressed by experts, in many of the important centers of manufacture. Besides other distribution, copies of the committee reports will be available at these meetings."

* * *

If carbide cutting tools chatter, look for the trouble in (1) excessive tool overhang; (2) insufficient end-cutting-edge angle; (3) too large a tool nose radius; (4) insufficient feed; (5) too much tool clearance (too large tool relief angles); (6) too large rake angles (but reduce these only as a last resort). If carbide tools wear rapidly, look for (1) insufficient feed, causing rubbing; (2) insufficient clearance (too small tool relief angles); (3) excessive chatter and vibration.

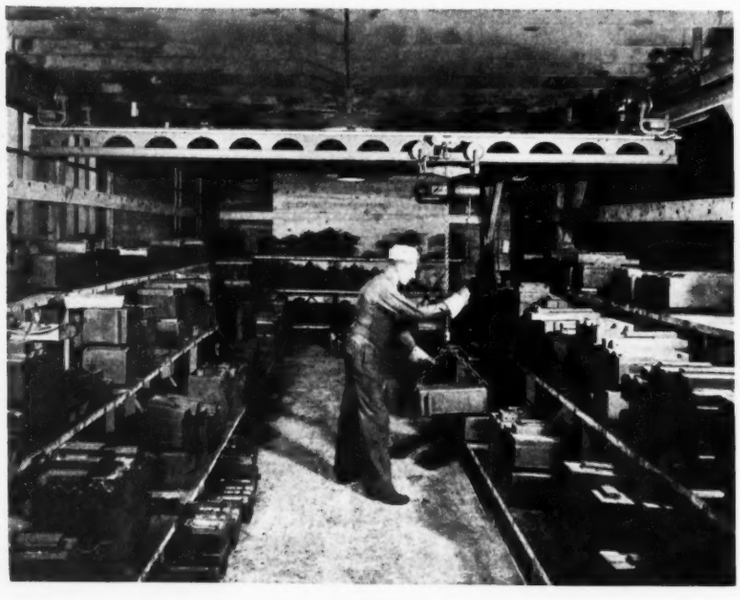
Jones & Lamson Offers Educational Film

The Jones & Lamson Machine Co., Springfield, Vt., has prepared two slide films to provide technical training schools and other institutions giving technical courses with material for instruction in inspection by optical projection and automatic thread grinding. The films show applications of Jones & Lamson optical comparators and automatic thread grinders, which are playing an important part in the Defense Program. Each film is accompanied by a written description in lecture form that describes the use and application of these machines.

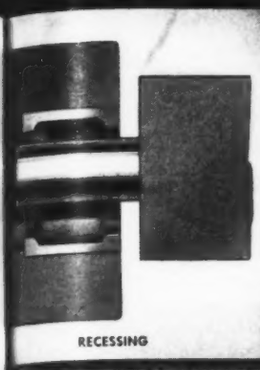
The optical comparator film shows examples of the many objects that can be inspected or measured by optical projection far more rapidly and accurately than could be done by mechanical means, one example being the inspection of the buttress threads of air-cooled airplane engine cylinders for lead and form.

The automatic thread grinder film illustrates the principal parts of the machine, its method of operation, and examples of the kind of work turned out, ranging from large worms for gear generators down to small fine-pitch instrument gages.

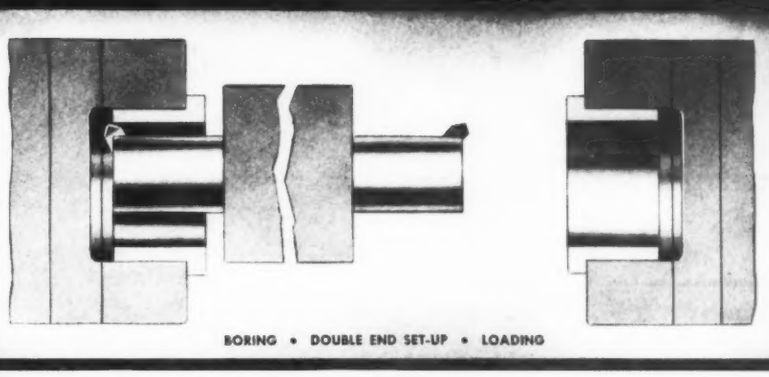
The films can be used with any standard 35-millimeter slide film projector. They will be sent without charge to any university, technical school, or other institution providing technical courses, upon the request of the principal.



An Exceptionally Well Arranged Room for Storing Heavy Dies in the Plant of the Fairmount Tool & Forging Co., Cleveland, Ohio. Every Die is Stored in its Own Numbered Position. Note the Convenient Arrangement of the Shelves. The Cleveland Crane & Engineering Co.'s Crane, the Range of which Covers the Entire Room, Makes it Possible to Pick up and Deliver Heavy Dies at a Moment's Notice

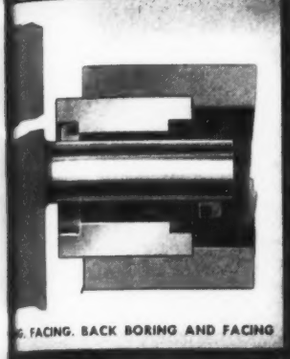


RECESSING



BORING • DOUBLE END SET-UP • LOADING

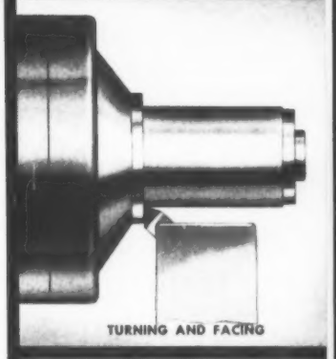
TAPER BORING



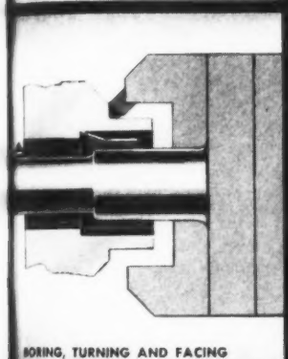
G, FACING, BACK BORING AND FACING

DESIGNED FOR MANY JOBS!

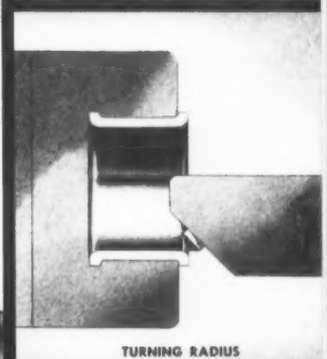
Ex-Cell-O Standard Boring Machines Perform Numerous Operations . . . Simultaneously



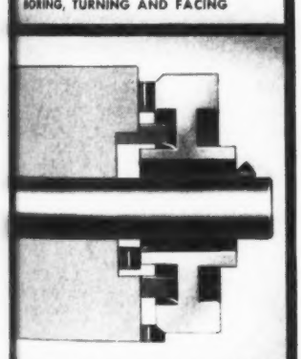
TURNING AND FACING



BORING, TURNING AND FACING

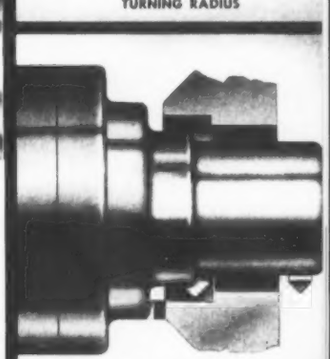


TURNING RADIUS



G, TURNING, FACING AND CHAMFERING

Illustrated here is a combined operation on an Ex-Cell-O Precision Boring Machine (Style 1212-A —Junior Double End) with an Ex-Cell-O Universal Fixture. Job is boring, facing, turning and chamfering brass aircraft gyro part with extremely close tolerances and on a production basis. Inspection has been minimized and other costs substantially reduced.



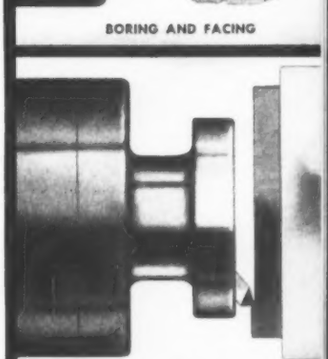
BORING AND FACING

TAPER TURNING

IN MACHINING interchangeable parts, there are varied possibilities to an Ex-Cell-O Precision Boring Machine. Not only will it rough and finish bore holes—straight, taper, blind, interrupted—but it will also turn, face, chamfer, groove, with almost any combination accomplished at the one time. Some of these single and combined operations are indicated by the surrounding sketches. And every Ex-Cell-O Boring Machine is a *Precision* Machine, with exclusive Ex-Cell-O features of design and construction that assure the greatest production of uniform work to the closest possible limits in size and finish. These Ex-Cell-O Precision Boring Machines (there are five standard styles) are enabling many manufacturers to meet successfully the unparalleled demand for defense items.

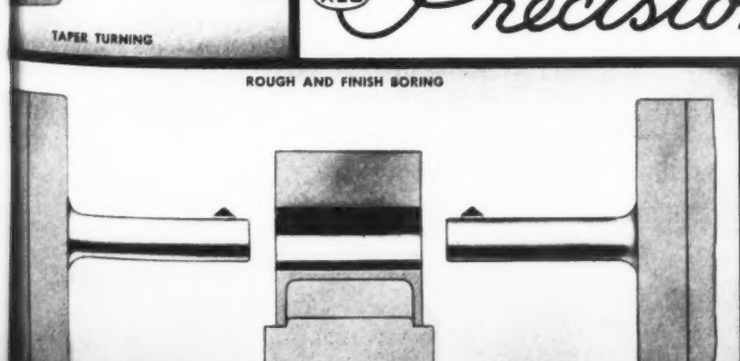
EX-CELL-O CORPORATION • DETROIT, MICH.

EX-CELL-O (XLO) *Precision* **MACHINES AND TOOLS**

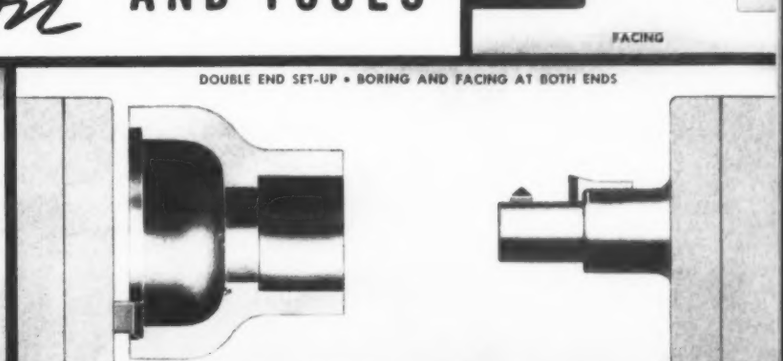


FACING

ROUGH AND FINISH BORING



DOUBLE END SET-UP • BORING AND FACING AT BOTH ENDS



NEWS OF THE INDUSTRY

California

ARCHIE A. MORRIS has been appointed Southern California representative for the McKenna Metals Co., Latrobe, Pa., manufacturer of Kennametal steel-cutting tools and blanks. Mr. Morris will have offices at 4905 Santa Fe Ave., Los Angeles, Calif.

Illinois

WHEELCO INSTRUMENTS CO., Chicago, Ill., manufacturer of indicating and control instruments, announces that it is moving into its own building at Harrison and Peoria Sts., Chicago, which will afford the company many times the amount of space formerly available. It is expected that the personnel of both the factory and offices will be doubled.

F. G. GARDNER of the engineering staff of the Kellogg Switchboard & Supply Co., Chicago, Ill., has been appointed to the position of acting chief engineer. Mr. Gardner has had forty years experience in the electrical industry; before going with the Kellogg company he had extensive experience in both the telephone and telegraph fields.

R. S. ERNST has been appointed representative in the states of Indiana, Wisconsin, and parts of Illinois for the Hele-Shaw Pump Division of the American Engineering Co., Philadelphia, Pa. Mr. Ernst's headquarters will be at 844 Rush St., Chicago, Ill., Room 329.

OHMITE MFG. CO., Chicago, Ill., manufacturer of rheostats, resistors, tap switches, etc., has recently completed a large addition to the company's factory on West Flournoy St., Chicago.

Indiana

HOWARD T. WALSH has retired from the Sullivan Machinery Co., Michigan City, Ind., on a pension, after forty-one years of continuous service. Mr. Walsh joined the company upon graduation from the Worcester Polytechnic Institute, and served successively as an apprentice in the company's training course, salesman in the Denver territory, Pacific Coast manager, London manager, general sales manager, vice-president, and director.

GENERAL ELECTRIC CO. is preparing to erect a $20,000,000 factory at Fort Wayne, Ind., for the manufacture of turbo-superchargers for airplanes. The building will cost $5,000,000, and the machinery and equipment $15,000,000. Approximately 6000 employes will be required at peak production.

OATIS-BOOTH MACHINERY CO., dealer in machinery, tools, and compressors, has been formed with offices in the Merchants Bank Bldg., Indianapolis, Ind., and in the Richardson Bldg., Toledo, O. The firm members are H. E. OATIS, P. E. BOOTH, L. S. DAVIES, and J. P. STAPLETON.

ARTHUR P. EMMERT, works manager of the Warner Gear Division of the Borg-Warner Corporation, Muncie, Ind., was elected a vice-president of the Warner Gear Division at the last annual meeting of the company.

Michigan

ENGINEERING SERVICE, INC., 3445 W. Fort St., Detroit, Mich., has been organized to specialize in the design of tools, dies, jigs, fixtures, gages, and special machinery. The president is E. C. MCKENZIE, efficiency engineer and formerly assistant sales manager of the X.L.O. Aircraft Corporation; secretary-treasurer, GEORGE T. KOCH, formerly chief engineer of the Detroit Auto Specialties Corporation; and chief engineer, FRANK H. MILLER, previously chief tool designer of the American Can Co., Waukegan, Ill.

DANIEL M. WATTS, formerly management engineer acting in the capacity of assistant general manager for the Bendix Aviation Corporation, South Bend, Ind., has assumed new duties as factory manager of the Kaydon Engineering Corporation, Lakeshore Drive, Muskegon, Mich. The Kaydon Engineering Corporation was recently organized by A. Harold Frauenthal, for a number of years vice-president and general manager of the Bantam Bearings Corporation. The corporation specializes in bearings for defense purposes.

Daniel M. Watts, Factory Manager of the Kaydon Engineering Corporation

ANDERS PETTERSON is the new chief engineer of the Giern & Anholtt Tool Co., Inc., Detroit, Mich., builder of carbide and diamond boring machines. Mr. Petterson was for years assistant to Warren Noble, experimental engineer of the Bower Roller Bearing Co., and resident engineer of the I M O Industries, Stockholm, Sweden.

S. A. HARRIS has been appointed eastern regional manager for the Detroit Rex Products Co., Detroit, Mich., to replace W. F. NEWBERY, who has been promoted to a position involving special duties at Detroit.

ORAL B. WRIGHT has been appointed director of sales and advertising for the David J. Ross Co., Benton Harbor, Mich., manufacturer of punch presses. Mr. Wright was previously a sales consultant for a number of manufacturers.

Missouri and Nebraska

W. L. GOURLEY, president of the Lehmann Machine Co., St. Louis, Mo., has also been elected treasurer, and L. A. CARTER has been made secretary. PAUL LEHMANN, vice-president, and A. H. LEHMANN, secretary, have resigned.

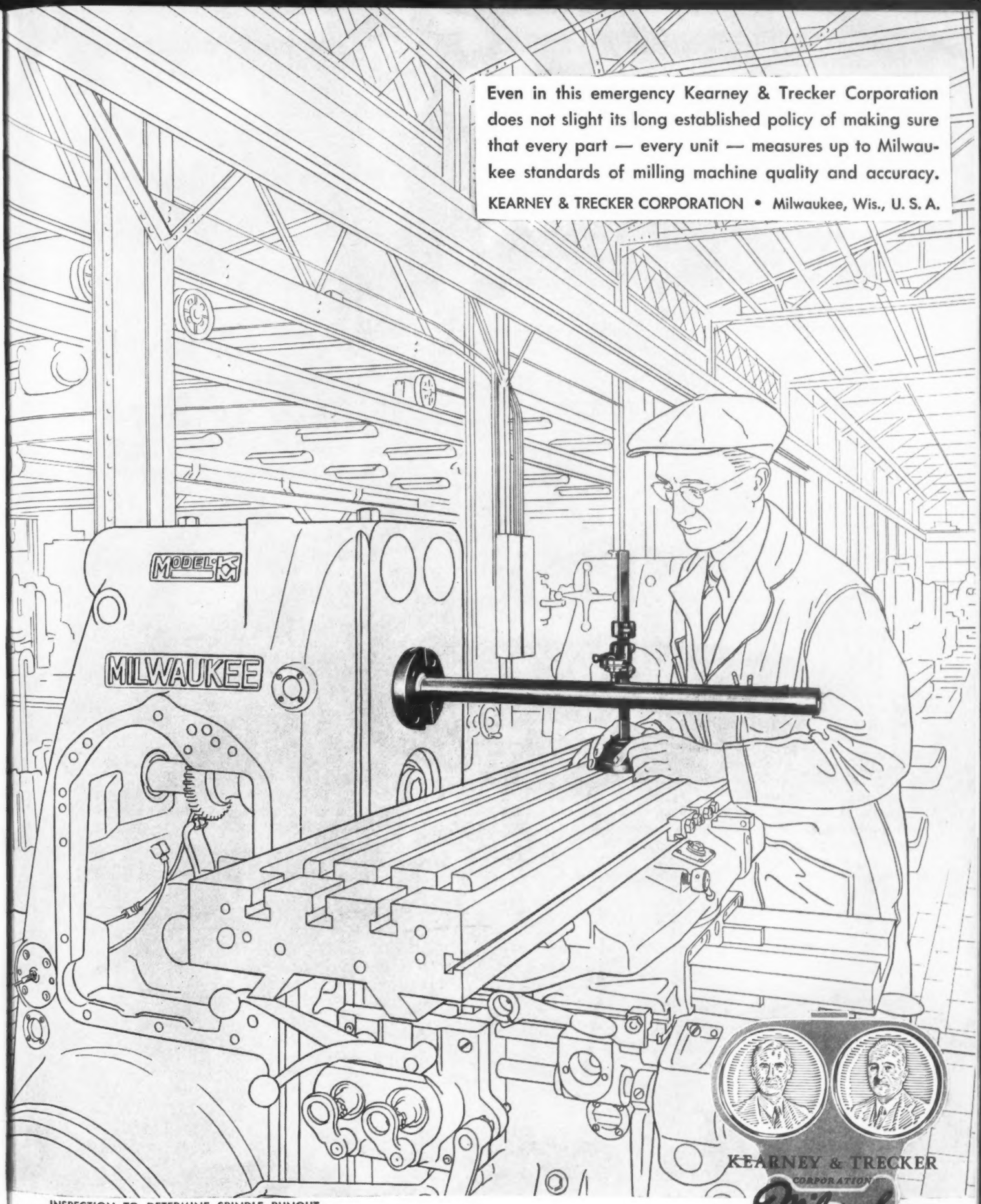
FOXBORO CO., Foxboro, Mass., announces that the company's St. Louis office is now located at 3615 Olive St. E. B. Miller is manager of that office.

LINCOLN R. SCAFE has been appointed general manager of the Glenn L. Martin-Nebraska Co., and will take charge of the new plant now being built at Omaha, Neb., for the manufacture of Martin B-26 bombers. Mr. Scafe was, until recently, general manager of the Fisher Division of the General Motors Corporation at Cleveland, Ohio.

New England

CHARLES F. HAMMOND, for twenty-two years chief metallurgist of the Winchester Repeating Arms Co., and more recently superintendent of the Cartridge Division, has resigned to become assistant to the president of the A. F. Holden Co., New Haven, Conn., manufacturer of heat-treating baths and equipment.

MINIATURE PRECISION BEARINGS announces that the company is now located at its new plant at Keene, N. H.



Even in this emergency Kearney & Trecker Corporation does not slight its long established policy of making sure that every part — every unit — measures up to Milwaukee standards of milling machine quality and accuracy.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wis., U. S. A.

KEARNEY & TRECKER CORPORATION
Milwaukee
MILLING MACHINES

INSPECTION TO DETERMINE SPINDLE RUNOUT.

Milwaukee MILLING MACHINES

New York

VASCOLOY-RAMET CORPORATION, North Chicago, Ill., manufacturer of tantalum-tungsten carbide tools, blanks, dies, and wear-resisting parts, has opened a district sales engineering office at 50 Church St., New York City. Sales and service for the New York area were previously handled from the Vascoloy-Ramet eastern plant in Jersey City. EUGENE ROTH, eastern district sales manager, will be in charge of the New York office, and will be assisted by ALAN CARVER, HARRY J. CHASE, and STANDISH ROWE.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., recently broke ground for the corporation's new plant at Dunkirk, N. Y., which, when completed, will produce alloy steel for defense purposes. This plant will cost approximately $4,000,000. It is being financed by the Defense Plant Corporation. The rolling mill equipment comprises eighteen stands of rolls. The building, a brick and steel structure, will be 875 feet long by 215 feet wide.

C. C. BRADLEY & SON, INC., Syracuse, N. Y., manufacturers of power hammers, have been reorganized after nine years of operation under equity receivership. The company was incorporated in 1832, and the first Bradley hammer was built in 1872. The depression came when the company was in the midst of an expansion program, resulting in a receivership. The officers of the reorganized company are DANA W. NORRIS, president and treasurer, and GOODWIN BRADLEY, vice-president and secretary.

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y., was recently awarded the Flag of the Bureau of Ordnance of the Navy Department in recognition of outstanding performance in the National Defense Program. The honor was conferred upon the company by Secretary of the Navy Knox, and was received for the company by HERBERT EISENHART, president, and CARL S. HALLAUER, vice-president.

LYON IRON WORKS, Greene, N. Y., manufacturers of material-handling equipment, have changed the firm name to LYON-RAYMOND CORPORATION. The change relates to the name only, the management remaining the same. George G. Raymond has been president of the organization for the last nineteen years. The business was originally founded in 1840 by George R. Lyon, and was conducted under the management of three generations of the Lyon family.

ARMA CORPORATION, 254 Thirty-Sixth St., Brooklyn, N. Y., has been awarded the Navy Department's Ordnance Flag and "E" pennant for efficient and meritorious service and contribution to the Navy's part in the National Defense Program. The presentation was made by Secretary Knox on July 25 in his office in Washington.

KINNEY & ASKEW, LTD., has been organized at 415 Lexington Ave., New York City, to specialize in management engineering and industrial public relations. JOSEPH KINNEY, JR., is president of the company, and THEODORE J. KAUFELD is a director. DEAN ASKEW is treasurer.

GROBET FILE CO. OF AMERICA, 3 Park Place, New York City, announces that the company recently received on a Swiss chartered boat a large shipment of Grobet Swiss files. Shipments of these files have also arrived on an American vessel through a neutral port.

EQUIPMENT CORPORATION OF AMERICA, 1150 S. Washtenaw Ave., Chicago, Ill., dealer in rebuilt machinery, has opened a New York office in the Hudson Terminal Building. JOHN A. CONBOY will be in charge of the new office.

J. W. COLGAN, formerly manager of Handy & Harman of Canada, Ltd., Toronto, has returned to New York in the capacity of sales manager of the parent company, with headquarters at 82 Fulton St., New York City.

EDWARD M. KIMBALL has been appointed New England representative for the McKenna Metals Co., Latrobe, Pa. Mr. Kimball's headquarters will be at 50 Church St., New York City.

HOBART BROTHERS CO., Troy, Ohio, has appointed JOHN L. FOLEY, 313 Herman St., Buffalo, N. Y., distributor for the company's arc welders and supplies in the Buffalo territory.

Ohio and Pennsylvania

D. G. BAXTER has been appointed general superintendent of the Warren, Ohio, plant of the Copperweld Steel Co. Mr. Baxter is a graduate of Ohio Northern University, and is widely known in the steel business. He has previously been associated with the American Steel & Wire Co., Pittsburgh Crucible Steel Co., Republic Steel Corporation, and National Tube Co.

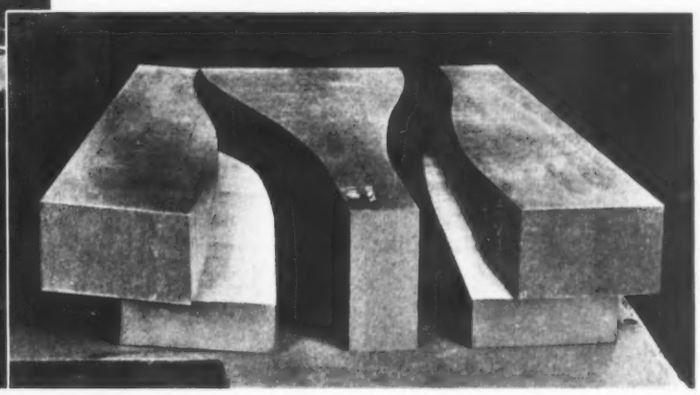
FOXBORO CO., Foxboro, Mass., manufacturer of measuring and control instruments, announces that the Cincinnati office of the company has been moved to 607 American Bldg., Walnut St., and Central Parkway.

CLARENCE E. WRIGHT has joined the Charles Dreifus Co., Widener Bldg., Philadelphia, Pa., dealer in iron and steel scrap, in the capacity of vice-president. Mr. Wright was connected for twenty-one years with the *Iron Age*, the last five years of which he served as managing editor.

JESSOP STEEL CO., Washington, Pa., has begun the construction of a new

A View in the New Drafting and Engineering Rooms of the Warner & Swasey Co., Cleveland, Ohio. These Departments Occupy the Entire Fifth Floor of the Main Building (16,000 Square Feet). An Unusual Feature is the Lighting which is Produced by 1140 Fluorescent Tubes Covered with Diffusing Louvered Glass that is Flush with the Acoustically Treated Ceiling. These Lights Provide Forty Foot-candles on the Drawing-boards. The Room is also Air-conditioned both Summer and Winter. The Air Movement is at the Rate of 16,000 Cubic Feet per Minute

METAL SAWING IS DUCK SOUP FOR THE DoAll



On the DoAll, the Hawthorne Metal Products Co., Detroit, Mich., cut the five sections of a die from one block of boiler plate steel 5" thick, 16" long, 14" wide—only 4 cuts of the saw necessary.

DO-ALL Contour Machine BAND SAWING BAND FILING BAND POLISHING

Time required on this job, only 1¾ hours for each cut, or at the rate of ¼" per minute. Saw used — a ½" 6 R.H. DoAll Band Saw. Speed—150 f.p.m.

GREATEST TIME SAVER EVER

The DoAll is the machine tool that is effecting unprecedented savings wherever installed, in machine shops, tool rooms, automobile and truck factories, railroad and aeroplane plants, arsenals and shipyards, etc.

The DoAll is an all-purpose machine—does internal and external band filing, sawing and polishing on any kind of metal or alloy. Handles work at various angles.

Let us send a factory trained man to your plant to show you how a DoAll will handle your cutting jobs.

FREE — Literature and 158-page Handbook on Contour Machining.

CONTINENTAL MACHINES, Inc.

1312 S. Washington Ave., Minneapolis, Minn.

Associated with the DoAll Co., Des Plaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines

DoALL GRINDER

A super precision surface grinder — a real production tool. Less vibration because motor is built right on the ball-bearing spindle. Work table has exceptionally large bearing surface. Hydraulic table travel is infinitely variable, up to 50 f.p.m.

84-inch, two-stand plate mill. The new mill will be housed in an extension to the sheet mill building consisting of four additional bays. Six modern heat-treating furnaces will also be added.

Texas

J. WALTER SNAVELY, district manager of the Chain Belt Co., in the Houston, Tex., territory for seven years, has returned to the sales department of the Conveying and Engineering Products Division of the company at Milwaukee, Wis. W. A. PITTS, formerly representative in Oklahoma City, has been appointed district manager of oil well sales at Houston. GEORGE HUNT has been appointed district manager of industrial sales at Dallas, Tex.

GEORGE B. EWING, JR., has joined the staff of sales engineers of the Houston, Tex., office of the Foxboro Co., Foxboro, Mass., manufacturer of instruments for process measurement and control.

* * *

Noteworthy Increase in Use of Carbide Tools

According to the Carboloy Company, Inc., Detroit, Mich., the production of carbide tool grades designed for machining steel is more than six times what it was last year; and the total production of carbide tools for the first six months of the year was four times what it was during the same period in 1940. The Carboloy Company has expanded its facilities several times in order to maintain its productive capacity for all types of carbide tools, dies, and blanks. Until recently the new plant, built in 1939, was adequate for the production increases, but to take care of the growing demand, an addition to the plant was recently started.

* * *

Teaching Teachers How to Teach

A course of teaching instruction for supervisors, foremen, and group leaders has been inaugurated by the RCA Mfg. Co., Camden, N. J., in order to teach these men how to instruct workers engaged in the manufacture of defense materials. In all, 350 people will receive this training, the course having been inaugurated with a group of eighty. Other classes will be formed later until the entire 350 receive instructions in how to instruct.

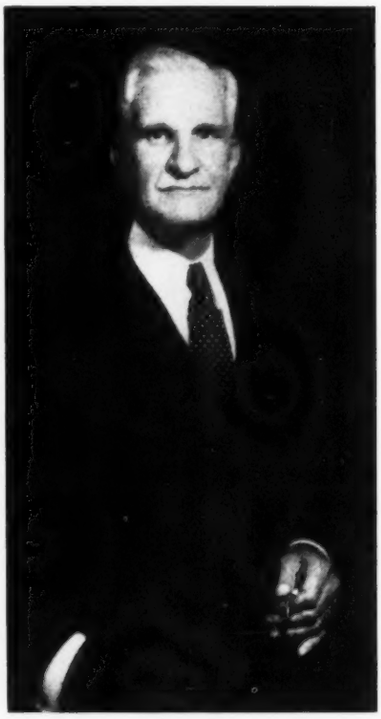
It is well known that men who, themselves, are proficient in performing certain types of work are not always capable of clearly instructing others how to do that work. Courses of this kind, therefore, serve a definite purpose in achieving results in industrial training.

OBITUARIES

George L. Markland, Jr.

George L. Markland, Jr., chairman of the board of the Philadelphia Gear Works, died in the Jefferson Hospital, Philadelphia, Pa., August 14, after an illness of several months. He was seventy-three years old.

Mr. Markland was nationally known in the gear manufacturing business.



George L. Markland, Jr.

For many years he was president of the Philadelphia Gear Works until, retiring from that position, he became chairman of the board. He took a very active interest in industrial association activities. He was a former president of the American Gear Manufacturers Association, a former director of the National Association of Manufacturers and of the National Metal Trades Association, and a member of the American Society of Mechanical Engineers and the American Society of Automotive Engineers. Since 1935, he had been president of the Philadelphia Board of Trade. Mr. Markland was also a member of the National Republican Club of New York, the National Academy of Social and Political Science, the Manufacturers and Bankers Club, the Machinery Club of New York, and the Engineers Club of Philadelphia.

Mr. Markland was an outstanding man in his field of endeavor. He had a forceful personality and an unusual ability to "hit the nail on the head." With this, he combined a friendly and genial attitude toward those with whom he came in contact. The host of friends that he had throughout the country will greatly regret to learn of his passing.

John Adam Smith

Colonel John Adam Smith, founder of the United States Electrical Tool Co., Cincinnati, Ohio, died on July 24 at the home of his daughter, Mrs. M. Lawrence in Cincinnati at the age of seventy-six years. Colonel Smith was born in New Richmond, Ohio. He early became interested in electrical engineering, and while still quite young, was superintendent of the old Main St. transportation road in Cincinnati. He developed the first street-car heater, installed the first street-car circuit breaker, and ran the first street-car sprinkler. Later he installed the first electric street-car system in Mexico City.

Colonel Smith became interested in the development of portable electric tools and built the first electric drill in a woodshed at his home. He contributed many inventions to the industry in which he was a pioneer, among which was the development of the first electric motor for portable drills. In 1897, he founded the United States Electrical Tool Co. He is survived by four sons and two daughters.

M. J. Tennes, Sr.

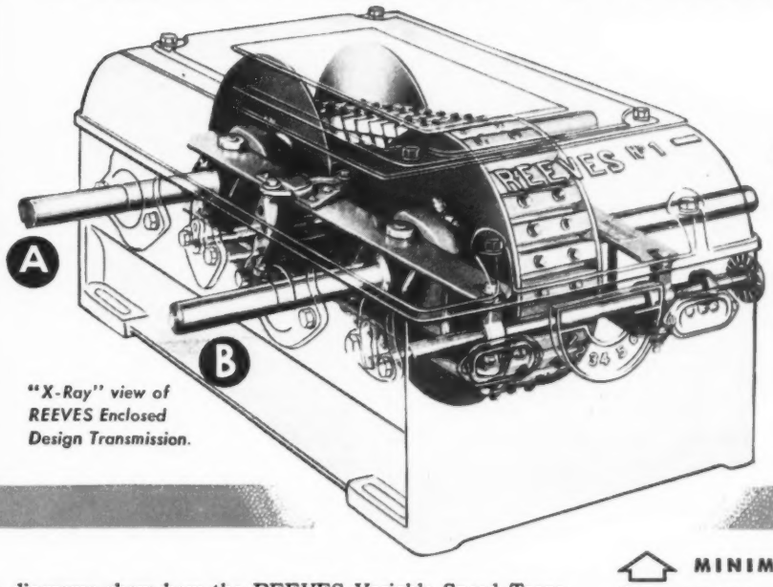
M. J. Tennes, Sr., chairman of the board of directors of the Shafer Bearing Corporation, Chicago, Ill., died recently. Mr. Tennes is survived by his widow; a daughter, Dorothy; and three sons, Captain Monte J. Tennes, Jr., president of the Shafer corporation, and now on active duty in the United States Army Air Corps; Ray P. Tennes, secretary-treasurer and director of the corporation; and Ensign Horace E. Tennes, also a director of the corporation and now on active duty in the United States Navy Air Corps. Mr. Tennes, Sr., had a host of friends in the bearing industry. His charming personality and good fellowship will long be remembered by those who were privileged to know him.

LOUIS H. MESKER, Cleveland, Ohio, who represented the Reed-Prentice Corporation, Worcester, Mass., in the Cleveland territory, died August 1 at the age of sixty-five years. Mr. Mesker had formerly been with the Kearney & Trecker Corporation, Milwaukee, Wis., and with the Cleveland Planer Co., Cleveland, Ohio. He was a prominent member of the Ohio State Engineering Society. For the last ten years, he had handled Reed-Prentice lathes and die-casting machines in Cleveland, and since 1937, the company's plastic injection molding machines.

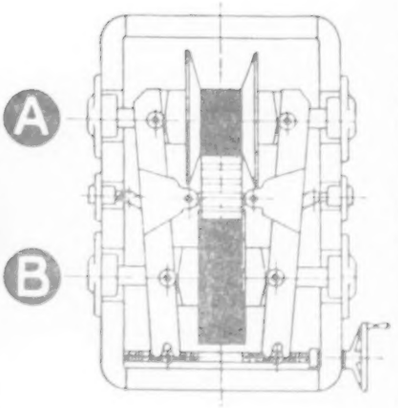
AUGUST W. SIDELL, retired demonstrator for the Gisholt Machine Co., Madison, Wis., died recently at the age

THIS *time-tested* PRINCIPLE

BRINGS THE ADVANTAGES OF ACCURATE SPEED CONTROL TO ALL TYPES OF PRODUCTION MACHINES



"X-Ray" view of REEVES Enclosed Design Transmission.



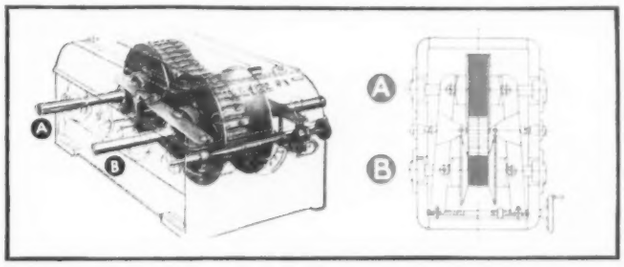
These diagrams show how the REEVES Variable Speed Transmission provides any driven machine with infinite speed adjustability. The rugged REEVES endless cord V-belt drives between two pairs of cone-faced discs which are adjustable to form an infinite number of driving and driven diameters. The discs are mounted on parallel shafts. One shaft receives power at constant speed from the motor. The other delivers power at infinitely adjustable speeds as the V-belt assumes different diameters of contact against each set of discs. Power is transmitted positively because of *non-slipping*, wedge-like action of belt. Equally important—any speed setting is maintained without fluctuation because belt tension is automatically controlled at *all* driving diameters. With this speed adjustability, positive and accurate over full range, a machine can be operated at greatest efficiency under every changing condition. . . . Find out how easily and inexpensively REEVES Speed Control may be applied to the machines in your plant. Nation-wide engineering service. Write us.

MINIMUM SPEED

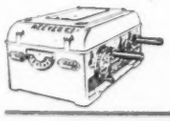
On constant speed shaft "A," cone-faced discs and speed-changing levers are *farthest apart* while the V-belt runs at *smallest* diameter between the discs. On variable speed shaft "B" reverse is true and shaft runs at *minimum* speeds.

MAXIMUM SPEED

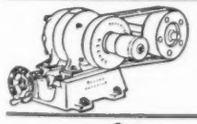
On constant speed shaft "A," cone-faced discs and speed-changing levers are *closest together* while the V-belt runs at *largest* diameter of the discs. On variable speed shaft "B" conditions are reversed and this shaft runs at *maximum* speed.



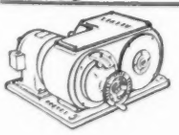
REEVES *Accurate Positive* SPEED CONTROL



VARIABLE SPEED TRANSMISSION for infinite speed control over wide range—2:1 to 16:1 inclusive—and for heavy duty service. Fractional to 78 h.p. Vertical and horizontal designs.



VARI-SPEED MOTOR PULLEY for direct application to shaft extension of any standard constant speed motor and for ratios of speed variation not exceeding 3:1 range. Fractional to 15 h.p.



MOTODRIVE—combines motor, variable speed drive and gear reducer (if needed) in single compact unit. To 10 h.p.; speed range 2:1 through 6:1.

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of seventy-six. He was one of the earliest members of the Gisholt field organization, having served as a demonstrator for several years before being sent to Europe in 1904. Ten years later he returned to the United States, continuing as a member of the Gisholt demonstrator staff.

H. S. STURGES, traffic manager of the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., died recently after a short illness. Mr. Sturges had been associated with the Manhattan organization for thirty-three years.

COMING EVENTS

SEPTEMBER 17-19 — Annual conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at the Royal York Hotel, Toronto, Canada. For additional information, address National Industrial Advertisers Association, Inc., 100 E. Ohio St., Chicago, Ill.

SEPTEMBER 20-OCTOBER 18 — CIVILIAN AND NATIONAL DEFENSE EXPOSITION at the Grand Central Palace, New York City. For further information, address Edward F. Korbel and Worth Colwell, 570 Lexington Ave., New York City.

SEPTEMBER 25-26 — National Tractor Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Schroeder Hotel, Milwaukee, Wis. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 1-2—CONFERENCE ON PERSONNEL AND INDUSTRIAL RELATIONS OF THE AMERICAN MANAGEMENT ASSOCIATION at the Benjamin Franklin Hotel, Philadelphia, Pa. For further information, address the American Management Association, 330 W. 42nd St., New York City.

OCTOBER 12-15—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Louisville, Ky. C. E. Davies, secretary, 29 W. 39th St., New York.

OCTOBER 16-18 — Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Royal York Hotel, Toronto, Canada. Ford R. Lamb, executive secretary, 2567 W. Grand Blvd., Detroit, Mich.

OCTOBER 20-22 — Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Edgewater Beach Hotel, Chicago, Ill. J. C. McQuiston, manager-secretary, 602 Shields Bldg., Wilkinsburg, Pa.

OCTOBER 20-24—Twenty-third NATIONAL METAL CONGRESS AND EXPOSITION to be held in Convention Hall and Commercial Museum, Philadelphia, Pa. Further information can be obtained from W. H. Eisenman, secretary, American Society for Metals, 7301 Euclid Ave., Cleveland.

OCTOBER 30-NOVEMBER 1—National Aircraft Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Astor, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

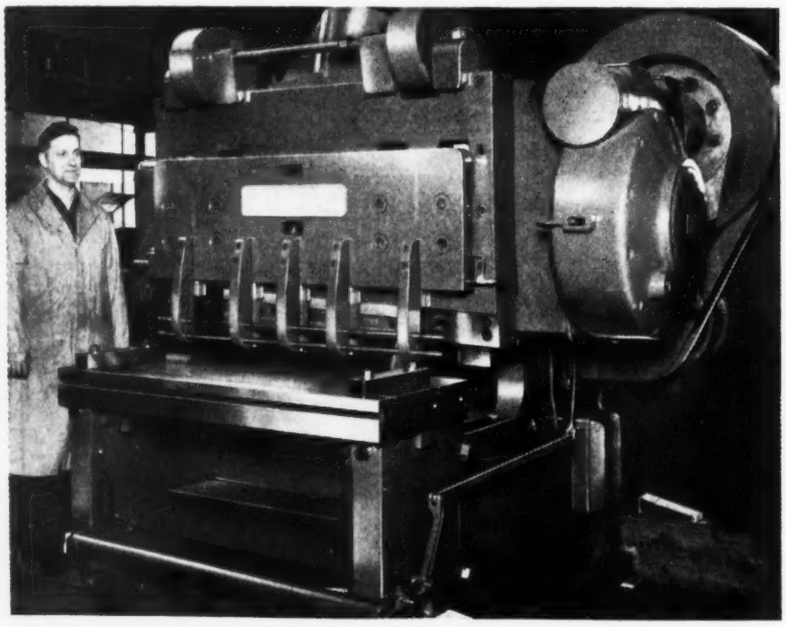
DECEMBER 1-6 — EIGHTEENTH EXPOSITION OF THE CHEMICAL INDUSTRIES at Grand Central Palace, New York City. For further information, address Exposition of Chemical Industries, Grand Central Palace, New York City.

JANUARY 12-16, 1942—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

NEW BOOKS

THE STARRETT BOOK FOR STUDENT MACHINISTS. 184 pages; over 200 diagrams and iillustrations, and 30 reference tables. Published by the L. S. Starrett Co., Athol, Mass. Price, 75 cents.

As a timely contribution to defense training, the L. S. Starrett Co. has prepared this manual of modern shop practice for use in shop training classes and metal-working courses. The new book combines much of the material formerly published in the "Starrett Book for Machinists' Apprentices" and the "Starrett Machinists' Data Book." The text was prepared in cooperation with a number of vocational school and industrial shop training instructors. It includes information on how to read working drawings; precision tools and measuring practices; how to read a micrometer and a vernier; fits and limits of tolerance; bench work; drilling; lathe work; toolmaking; etc.



A New Cincinnati Rolling-mill Shear Weighing Approximately 40,000 Pounds Recently Furnished to the Anaconda American Brass Co. for the Continuous Mill Cutting of Brass and Zinc. This Machine is of Rolled Steel Plate Welded Construction, Having Hydraulic Hold-downs and Automatic Lubrication. It Makes 30 Strokes a Minute